March, 1956

RECORDS of RESEARCHES

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FACULTY of AGRICULTURE

UNIVERSITY of TOKYO

No. V (1954 - 1955)

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Contents

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I. Agriculture

Abstract Nos. 1 — 13

1. Studies on the formation of ascorbic acid (vitamin C) in plants. 6. Relation among formation of ascorbic acid, development of chlorophyll and beginning of photosynthesis. Tomota SUGAWARA (Jap. Journn. Bot. 15: 10-14, 1955)

Helianthus annuus L., *Zea Mays* L., *Brassica Rapa* L., *Vicia Faba* L., and *Avena sativa* L. were employed in this experiment. Seeds of these plants were germinated in quartz sands at 25°C, in an air-conditioned darkroom. When germinated, all seedlings were grown in the darkroom at about 25°C for 10 days and then the etiolated seedlings were continuously exposed to light at 2,000 Lux. The chromatographic adsorption technique was used to separate and isolate the green pigments. Further in order to identify the pigments involved, their absorption spectra were taken by means of a BECKMAN spectrophotometer. Seedlings were tested for the liberation of oxygen before exposure to light, every 15 minutes for a period 220 minutes. Luminescent bacteria were used to detect the presence of oxygen.

Leaves of dark-grown seedlings become green by illumination, and only after about two or three hours chlorophyll 'a', 'b' were detected. In etiolated seedlings, however, chlorophyll 'a' was formed much more rapidly than chlorophyll 'b', when the plants were first exposed to light, regardless of the spectral region employed. Chlorophyll 'b' is not essential for the initiation of photosynthesis and the formation of ascorbic acid, although chlorophyll 'b' is, without exception, contained in the leaves of normal green land plants. From the results of this experiments, it may certainly be stated that the formation of ascorbic acid has a close connection with the initiation of photosynthesis, but has no direct connection with the appearance of chlorophyll 'b'.

2. Influence of nitrates on the germination of seeds under oxygen supply of various concentrations. Tomota SUGAWARA (Proc. Crop Sci. Soc. Japan **23**: 295-296, 1955)

In connection with the investigation on the biochemical reduction of nitrate by plants, an opportunity was afforded to study the effect of nitrates on the germination of seeds. Seeds were treated with nitrate solution and were germinated on moist filter paper in a dark thermostat kept at 25°C. The germination of seeds were found to be affected by applying nitrate from outside. Tomato, tobacco, lettuce and radish seeds could be accelerated in germination under the ordinary air and the air with lowered oxygen concentration when presoaked in 0.02～0.005 M potassium nitrate solution. The effect of nitrate, however, was not decisive on barley and maize seeds.

In the previous paper, the author has reported the fact that a close correlation exists between the reducing power of nitrate and the oxygen requirement of roots in tobacco and tomato. Further, it was stated that nitrate is accelearted in the

respiration of plants under oxygen supply of various concentrations. According to these results, it may certainly be concluded, that the nitrate is closely correlated with the respiration of plants.

3. Relationship between iron, manganese, zinc and copper contents in rice plant and its resistance to the wilting disease (*Piricularia Oriyzae*). Etuo KAMATA (Proc. Crop Sci. Soc. Japan **23**, 281-282, 1955)

The variation in the iron, manganese, zinc and copper levels in the leaf of rice plant of the susceptible variety was found definitely to be related to the intensity of susceptibility of the plant to wilting disease.

In general, high concentrations of those elements strengthen the plants resistance: the phenomenon was proved not to be dependent on the nitrogen, magnesium, calcium or silica levels in the plant body.

4. Studies on CO_2 exchange in crop plants. I. On the apparatus for continuous measuring of CO_2 exchange in crop plants. II. Changes in the assimilation and respiration rate associated with the growth of rice plant. Yoshiji TOGARI, Tomoshiro TAKEDA and Hiroshi MARUTA (Proc. Crop Sci. Soc. Japan **23**, 207-213, 1955)

The apparatus deviced by us, gives a nearly instantaneous measuring of the CO_2-exchange of a whole plant under natural conditions, and the measurement can be carried out for a long time. This apparatus is divided into 4 main parts: (1) The main stream system consisting of a plant chamber, gas-meter and an exhauster. The chamber is set upon WAGNER's pot in which the plant is cultured, the air is supplied to the chamber by driving the exhauster, and its volume indicated by a gas-meter. (2) Air-sampling-cylinder. A pair of air-sampling-cylinders driving at intervals of 5 min. alternatively, samples 350 cc. of air per min. from main stream and delivers it to the absorber. (3) Absorber, which holds 50 cc. of CO_2-absorbing solution (1/50 NaOH + 1% Butyl-Alcohol), catches CO_2 completely from the air sample. (4) An electrode, which is inserted in the absorber, measures the changes of electro-conductivity caused by CO_2 absorption with the help of KOHLRAUSHE's Bridge.

In 1953, CO_2 exchange in rice plant cultured in a pot was investigated by using the apparatus mentioned above, and data obtained are as follows:

(1) Diurnal changes of apparent photosynthesis and respiration were investigated at various growing stages.

The total daily CO_2 assimilation level increases gradually in proportion to the growth, and reaches the maximum amount at the end of the vegetative stage or the beginning of the reproductive stage, then decreases gradually and keeps nearly the same level from booting to heading, and then decreases rapidly during the ripening stage. Otherwise total night respiration level increases gradually accompanying with the growth, and the maximum level appears in the stage from booting to heading, and then decreases gradually.

(2) The balance between growth (dry-matter productivity) and carbon dioxide exchange. Authors tried to compare the theoretical curve of increase in dry matter with the actual one, the former is calculated from net assimilation value, assumed on the basis of chemical analysis that the dry plant material contains 44% of carbon,

and the latter is derived from the actual growth curve.

There is approximate concordance between the experimental curve and the theoretical one in the early stages of growth. However, the former is considerably lower than the latter in later growing stages. This is due to the unfavourable climate in the later stages of growth, and also due to the fact that the estimation is made theoretically for sunny days only.

(3) From the light curve observed in this experiment, it may be said to be different demands for light for their maximum photosynthesis according to the vegetative or reproductive stage. It will be found that there is no appreciable increase in the rate of assimilation over 60～70 K. Lux at booting stage and 50～60 K. Lux at the vegetative stage. And in both cases, when the light intensity drops under 20 K. Lux, sudden reduction takes place in the rate of assimilation.

(4) During the daytime, in which vigorous CO_2 assimilation continues, CO_2 concentration in the field keeps the value of about 55 mg per 100 liters of air. In late afternoon, this gradually increases and a sudden increase in CO_2 concentration takes place after sun set, and then increases gradually during the night time, and finally reaches the maximum value of about 70 mg per 100 liters of air before sunrise. The concentration level decreases abruptly after the sun rise, and returns to the low daytime level of 55 mg until 10 a.m.

5. Studies on the alfalfa mosaic virus. Hidefumi ASUYAMA, Yasuo KOMURO and Koji SYODA (Jubilee Publ. Commem. 60th Birth. of Tochinai and Fukushi, 101-107, 1955)

A mosaic disease of alfalfa was noted in 1952. The symptom of mottling or chlorotic spots on the upper leaflets was mild and was masked in summer. Greenhouse experiments showed that the virus is transmitted readily by mechanical inoculation using carborundum, or by aphids, viz. *Myzus persicae*, *Aphis gossypii*, *A. medicaginis* and *A. pisi*, which are comparatively inefficient as vectors. The virus was capable of infecting hosts in 8 of the 19 families tested, including broad bean, bean, *Phaseolus angularis*, pea, soybean, cowpea, tobacco, *Nicotiana glutinosa*, red pepper, *Chenopodium album*, *Tetragonia expansa* and *Eschscholzia californica*. The local necrotic spots developed on the inoculated leaves of bean, cowpea, and *Tetragonia* are characteristic. The virus was not transmitted to cucumber, tomato, corn, *Commelina communis*, etc. The virus activity was lost when the juice was diluted beyond 1:1,000, or when exposed to 60°C for 10 minutes or subjected to aging in vitro for 2 days.

From the host range and physical properties, the virus in question was identified as a strain of Medicago virus 2 (*Marmor medicaginis* HOLMES). It may be identical with the strain described by ZAUMEYER (1938). Isolation of alfalfa mosaic virus from red pepper plants showing mosaic in the field failed, but from mosaic plants of red clover a strain of the present virus was isolated.

6. Studies on cucumber mosaic virus (I). The symptoms of mosaic disease of cucumber in Japan, and host range and properties of its causal virus. Yasuo KOMURO and Hidefumi ASUYAMA (Ann. Phytopath. Soc. Japan **19** [1-2], 18-24, 1954)

The symptoms of cucumber mosaic, which was noted in Tokyo in 1950, consisted mainly of mosaic and chlorotic spots on the leaves. Characteristic symptoms of yellow mottle or green warts on the fruits, as described by DOOLITTLE and other investigators in U.S.A., were not observed. Greenhouse experiments showed that the virus was readily transferred by mechanical inoculation using carborundum, or by aphids, viz. *Myzus persicae* and *Aphis gossypii* or through dodder, *Cuscuta japonica*, but not transmitted by cucumber beetle, *Aulacophora femoralis*. Tests for seed transmission yielded negative results. The virus was capable of infecting hosts including 26 species of 11 families in 34 species of 13 families tested. On cucumber, muskmelon, zinnia, tobacco, tomato, spinach, corn, *Commelina nudiflora*, etc., systemic infection was obtained inducing the symptoms of mosaic, veinclearing, veinbanding and less frequently malformation of the leaves. Local necrotic spots were developed on the inoculated leaves of watermelon, *Cucumis Melo* var. *Conomon*, cowpea, broad bean, pea, sesame, *Tetragonia expansa*, *Chenopodium album*, etc. The virus was infectious after heating at 60°C for 10 minutes. Tolerance to dilution varied according to tests from 1:1000 to 1:5000. Inactivation by aging in vitro was 2 to 4 days at room temperature. As a result of comparison of the symptoms, host range and physical properties, the virus under consideration is regarded to be identical with Cucumis virus 1 (*Marmor cucumeris* HOLMES). The apparent mild symptoms of cucumber may be attributed to the tolerance of the Japanese varieties to the virus.

7. Studies on the mechanism of the expressions of the translucent and lemon genes in the silkworm. V. On the movement of uric acid in the normal and the oily mutant. Hisao ARUGA and Hitoshi WATANABE (Journ. Seric. Sci. Japan **23**, 233-239, 1954)

After injecting uric acid solution into the normal and a few oily (*od, ok*) mutant silkworm larvae (in the 5th instar), the quantitative changes of uric acid in several organs and tissues have been investigated. In the feeding larva of the 5th instar, not only uric acid in the blood is not transported into the epidermal cells, but also uric acid contained in the epidermal cells does not flow out into the blood. In general, the holding power of uric acid of the integument, changes at the matured larval stage and uric acid flows out from epidermal cells into the blood. In this stage, if much uric acid is contained in the blood, a part of it is transfered to the epidermis. Both in the normal and the oily mutant larvae, most of uric acid in the blood is excreted through the Malpighian vessels, whereas some of it is excreted through the posterior portion of the mid-gut. It has been ascertained that the excretory power of uric acid in the feeding 5th instar larva of the oily mutant is larger than that of the normal. This phenomenon is mainly due to the fact that the excretory velocity of uric acid in the Malpighian vessels of the oily mutant is higher than that of the normal.

8. On the change of a few characters by high temperature-moisture shock in the silkworm, *Bombyx mori*. Hisao ARUGA and Shigemi KAWASE (Journ. Seric. Sci. Japan **23**, 240-243, 1954)

An experiment changing some characters by the treatment of high temperature-moisture shock before the 4th moulting period has been carried out using a few mutants of the silkworm. By this treatment, plain (*p*) having no melanin pigments in the cuticle showed normal marking having eye spot, crescents and star spots at the 5th instar. "Plain Multilunar" (*pL*) which has scarcely brownish melanin pigments specific to the Multilunar marking in the cuticle showed the resembled feature to normal Multilunar ($+^{p}L$) having dark brown melanin pigments in the cuticle by the high temperature-moisture shock. On the contrary the other strain such as "plain Ursapattern" (*pU*) showed no change by this treatment. A recessive mutant lemon yellow larva characterized by the yellow skin color was also treated by high temperature-moisture shock, and the yellow color due to the existence of xanthopterin-B increased.

9. On the catalase activity in the integument of some marking mutants in the silkworm. Hisao ARUGA, Shigemi KAWASE and Masaharu EGUCHI (Journ. Seric. Sci. Japan **23**, 292-295, 1954)

It has been ascertained that the catalase activities in the integuments of a few marking mutants (Striped, Zebra, Ursapattern etc.) are higher than those of the normal and plain, having no melanin pigments. In Zebra and Striped, the catalase activity in the pigmented parts due to the existence of melanin pigments in the integument is higher than that of non-pigmented one. The difference of the catalase activity in the integument between plain (*p*) and Striped (p^{s}) is due to the difference of the catalase activity in the cuticle in both strains ercept for the moulting period, and the difference in the epidermis is not recognized. From the above mentioned results, we presume that there are some relations between catalase activity and the formation of the melanin pigments or the internal condition of the integument having relations with the formation of the melanin pigments.

10. Biochemical genetics on the pigment in eggs and compound eyes of the silkworm. Sigemi KAWASE and Hisao ARUGA (Jap. Journ. Gen. **29**, 114-122, 1954)

Acid methyl alcohol extracts of the egg and eye pigment components of some eggs and eye color mutants of the silkworm, several wild-silkworms and *Drosophila melanogaster* have been discriminated by paper chromatography using formic acid as a solvent. Three pigments (orange, red and purple) with Rf values of 0.82, 0.76 and 0.50 respectively are found in the eyes and the eggs of the normal type of the silkworm, and denominated as +chrome-I, +chrome-II and +chrome-III respectively. The compound eyes of w_1 (white-1) and w_2 (white-2) do not contain those pigments, but the compound eye of w_3 (white-3) contains three pigments as that of the normal. The eye of *re* (red) contains large amounts of +chrome-I, containing no +chrome-II and III, while *od* (distinct oily) and w_3w^{ol} strains contain a little three pigments. On the serosa of the silkworm egg, w_1 lacks the three pigments and *re* contains +chrome-I only as in the eye, and both *od* and spain (brown color egg) contain small quantities of those three pigments. As to the appearances of these three pigments in the eggs and eyes, it is observable that at first +chrome-I is formed, which is followed by the formation of +chrome-II and +chrome-III. As +chrome-I has a peak at 450 mμ and it changes to yellow on addition of H_2O_2 and a pink precipitate is formed on

reduction with sodium hydrosulfite, so the +chrome-I is closely similar to the brown pigment of *Drosophila*. But +chrome-II dose not show any peak between 300-540 m μ, though +chrome-III has a peak at 520 m μ, and both pigments become colorless on addition of H_2O_2 showing no change by the treatment of hydrosulfite.

11. Biochemical studies on the voltinism in Lepidoptera. II. Studies on the effects of temperature during the pupal stage on the voltinism of the silkworm, *Bombyx mori* L. Narumi YOSHITAKE (Journ. Seric. Sci. Japan **23**, 343-348, 1954)

The mechanism on the changes of the pigmentation and hibernation of the eggs has been investigated by incubating the pupae in various temperatures (15, 20, 25 and 30°C) respectively using bivoltine races of the silkworm. The conditions of the incubation temperature in the stages of the pupa and of the egg at the next generation have some influences upon both the egg pigmentation induced by tryptophan metabolism and the egg hibernation, and the temperature in the pupal stage is more effective than that in the egg stage for the pigment formation. The most temperature-sensitive stage for the permeability of 3-hydroxykynurenine from blood to the ovary is the relatively early one of the middle of the pupal stage. When the pupa of this stage is incubated in a relatively low temperature (15-20°C) not injurious for the pupal physiological conditions, larger amounts of 3-hydroxykynurenine is transmitted from the pupal blood into the egg, than in the higher temperature incubation at 30°C, resulting in the darker pigmentation of the eggs laid in the former than in the latter. It may be plausibly said that the differences of the incubation determining the voltinism and the growth rate of the ovary, and finally control the amount of 3-hydroxykynurenine transmitted to the egg resulting the change of the egg pigmentation. The control of the permeability of the egg by the incubation temperature is not only observable in 3-hydroxykynurenine, but also in kynurenine. The parallelism between the egg pigmentation and hibernation mentioned above may be thought to be due to that the transmission to the egg of both the pigment forming substances and the inhibitor of the embryonal development, accompany each other.

12. Biochemical studies on the voltinism in Lepidoptera. III. On the change of the voltinism due to the injection of a few inorganic salts and other chemical substances. Narumi YOSHITAKE (Journ. Seric. Sci. Japan **23**, 349-356, 1954)

The present paper deals with the change of the voltinic characteristics due to the injection of a few inorganic salts and some inhibitors as enzymes, using two kinds of pupae, induced respectively by the low temperature incubation (15°C dark), and the high temperature one (25-26°C light) in the embryonal stages using four Chinese bivoltine races. The former usually will lay the non-hibernating eggs, but the latter lay the hibernating ones. The pupae induced by the low temperature incubation of the eggs, used in the experiments for the injection, were some pigmented and hibernating eggs obtained by the injection of KCl and Na-citrate. In the NaCl injection, a few lightly pigmented eggs were obtained, all of them being non-hibernating eggs. In the investigation on the effects of a few inhibitor for some enzymes, it was observed that Na-azide has some influences upon the change of the egg pigmentation and hibernation, and other inhibitors for enzymes produced very

lightly pigmented eggs, but they were all non-hibernating ones. The pheno type of the eggs from the female moth being injected with KCl, NaCl and K_2SO_4 in the pupal stages resembled the mutant kidney (ki) and this may be thought to be a kind of phenocopy. In the experiments using the pupae treated at the embryonal stage by high temperature the eggs not showing pigmentation and hibernation, a very high percentage, were later induced in almost all cases after the injection of some inorganic salts and a few inhibitors for some enzymes. The mechanism on the change of the voltinism induced by the injection of KCl and NaCl are thought to be different from the effects of the inhibitor for enzymes, and it may be plausibly said that K plays an important part in changing the non-hibernating eggs to the hibernating ones.

13. Biochemical studies on the voltinism in Lepidoptera. IV. On the responses of staining in the non-hibernating and hibernating eggs of the silkworm, *Bombyx mori* L. Narumi YOSHITAKE (Journ. Seric. Sci. Japan **24**, 108-113, 1955)

From the results of the investigations on the staining features of the eggs laid by the female moths of w_1 mutant which have been injected with neutral red, nile blue and bismarck brown in several pupal stages, it has been ascertained that the hibernating eggs are stained dark, while the non-hibernating eggs are rather pale. The eggs of the polyvoltine races were also stained rather lightly with those dyes, but they were paler than the non-hibernating eggs of the bivoltine. These differences are thought to be due to the difference in the permeability of those dyes into the ovary. The moths which were injected with the dyes, 5 or 6 days after pupation did lay stained eggs. Those which were injected, 9 or 10 days after pupation laid eggs of two types, stained and unstained. The eggs which were laid early in the oviposition were not stained, while those laid lately were stained. It was clearly observed in the disected moth that the unstained eggs had already cast off the follicle cells. The experiment shows that the follicle cells of the ova give the stainability to the colion, which is accelerated by the voltinic hormone secreted from the subesophageal ganglia.

II. Agricultural Chemistry

Abstract Nos. 14—54

14. Physico-chemical studies on the formation of humic acids (Part 2). Absorption spectra of humic acids (1). Kyoichi KUMADA (Journ. Sci. Soil and Manure Japan **25**, 217, 1955)

Following the previous report, the author studied the visible and ultraviolet absorption spectra of humic acids in alkaline solutions, which were extracted from paddy rice soils, peats and rotten stump by SIMON's method. The results are summarized as follows:

1. Absorption curves ($\log k-\lambda$ curves) of these humic acids were very similar

in their shape; and the intensity of light absorption increased generally toward the shorter wave length. The curves were nearly straight.

2. When these curves were expressed on the same concentrations of humic acids (0.01% solutions), they were generally not crossed; and there existed a reciprocal relationship between the intensity of light absorption coefficient at a given wave length and the inclination of the curve to the axis of wave length.

3. Humic acids having smaller light absorption had a weak absorption band in the ultra-violet region, but this band was not found in the case of those having stronger light absorption.

From these results, it may be reasonably said that the mechanism of light absorption of humic acids is essentially the same, and the intensity of their light absorption corresponds to their degree of humification, that is, the latter can be shown by their absorption spectra.

15. Physico-chemical studies on the formation of humic acids (Part 3). Absorption spectra of humic acids (2). Kyoichi KUMADA (Journ. Sci. Soil and Manure Japan **25**, 263, 1955)

Visible and ultra-violet absorption spectra were determined with the alkaline solutions of humic acids extracted by hot dilute alkali from soils and peats pretreated by 5% hydrochloric acid or not (among these humic acids the former was named SrL humic acids and the latter, L humic acids). The results are summarized as follows:

1. The shapes of absorption curves of these humic acids were very similar to those extracted by SIMON's method. The fact that humification degree of humic acids could be shown by their absorption spectra, was furthermore vertified by these results.

2. Light absorption of SrL humic acid, obtained from soil, was generally greater than that of L humic acid of the same soil; but in the case of wet paddy soils and peats, light absorption of L humic acid was greater than that of SrL humic acids.

3. SrL humic acids were fractionated by Mg^{++} into two parts, flocculated and non-flocculated; and the absorption spectra of both parts were determined and compared with each other.

16. Physico-chemical studies on the formation of humic acids (Part 4). On the artificial humic acids. Kyoichi KUMADA and Sunao MIYAZATO (Journ. Sci. Soil and Manure Japan **26**, 5, 1955)

Some studies were made on the effect of addition of various nitrogen compounds on the formation of artificial humus from glucose, and on the absorption spectra of artificial humic acids prepared from glucose, hydroquinon and lignin.

1. Yields of humus from glucose treated with hydrochloric acid were much increased with the addition of urea, and somewhat less in the case of amino acids containing benzen ring and hydroxylamine. But the addition of ammonium salts and aliphatic amino acids seemed to be indifferent to the yield. A greater part of nitrogen of urea added to the solution of glucose was found in the composition of artificial humus.

2. The absorption spectra of artificial humic acids, alkali-soluble part of humus, were almost similar to those of soil humic acid, but essentially not. All of artificial humic acids from glucose, by treating with hydrochloric acid or sodium hydroxyde,

were brought to show quite similar absorption curves, but those obtained by treating with sulfuric acid gave quite different curves in ultra-violet region. The absorption curves of humic acids prepared from hydroquinon by treating with sodium hydroxyde were apparently different from those from glucose.

3. Light absorption of alkali lignin, when treated by boiling HCl (1:1), increased its intensity especially in the visible region, and the inclination of the absorption curve decreased with the length of treatment.

4. Existence of nitrogen in these artificial humic acids caused no apparent changes in their absorption spectra.

17. Studies on the carbohydrates of soybeans. V. A hemicellulose fraction soluble in hot water. Isolation and component sugar determinations. Shin'itirô KAWAMURA, Tsuneo KOBAYASHI, Mitio ÔSIMA and Masahiro MINO (Bull. Agr. Chem. Soc. Japan **19**, 69, 1955)

Dehulled and defatted soybean meal was treated with 0.2% sodium hydroxide to give a sugar-free protein-extraction residue, from which hot-water-soluble hemicellulose was precipitated by adding ethanol to the concentrated hot-water extract. The hemicellulose fraction was purified through the copper complex formed by adding FEHLING's solution and acetone. Its decomposition point was 194~5° and $[\alpha]^{20}_D$ +97.5° and it consisted of pentoses (arabinose and xylose) 19.3% (as pentosan), uronic acid (galacturonic acid) 19.2% (as lactone), and hexose (galactose) 42.9% (as galactan). The methods of analysis are described in detail.

18. An electronically controlled micro Dumas apparatus. Tetsuro KÔNO, Michiko NAKAYAMA, Takeko MITSUI and Keiko SATO (Japan Analyst **3**, 304, 1954)

An apparatus for the automatic procedure of the microdetermination of nitrogen proposed by PREGL was described.

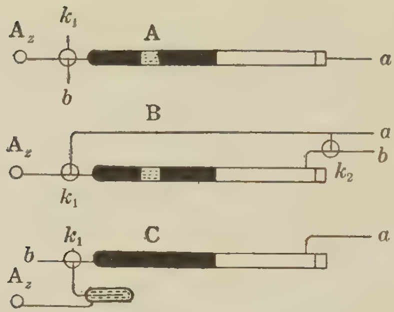
The apparatus and the procedure resembled, in general, to those proposed by GYSEL (Helv. **22**, 1088, 1941), but the movable furnace was moved at a rate of 13 mm/min. by a synchronized motor which was stopped whenever the pressure in the combustion tube was increased. The change of the pressure was detected by a manometer containing mercury.

19. A new automatic micro Dumas apparatus. Tetsuro KÔNO, Keiko SATO, Mizue SUZUKI and Ikuko ISOBE (Journ. Agr. Chem. Soc. Japan **28**, 744, 1954)

The automatic micro Dumas apparatus reported previously was improved. The main features of the improvements were as follows:

1. Reduced copper was placed in a small quarz tube which was separated from the combustion tube as it was shown in Fig. 1. Thus the oxidation of the reduced copper during the gas exchange was prevented, while the copper oxide in the combustion tube was reoxidized in the process, and the sample was never exposed to the hot gas as it was in GYSEL's system.

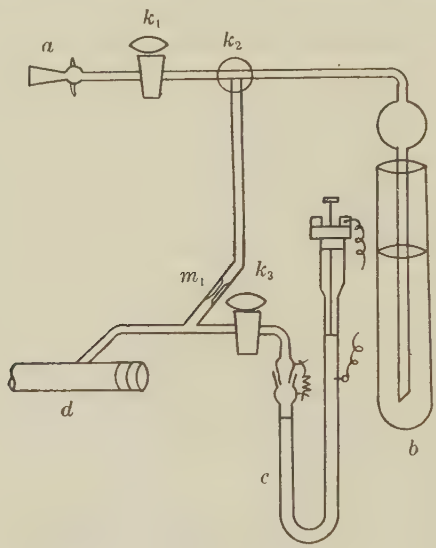
2. The pressure of the carbon dioxide was kept constant, and two capillary tubes were placed before and after the combustion tube. Thus the troublesome regulation of the fine stop cock at the manometer proposed by PREGL was no longer necessary.



A: Pregl's system, B: Gysel's system, C: proposed system
a: CO_2 entry, *b*: CO_2 outlet, A_z: azotometer, $k_{1,2}$: cocks,
▬: CuO, ░: Cu.

Fig. 1.

3. A manometer having electrodes and containing water solution of an electrolyte was placed as it was shown in Fig. 2. When the pressure in the reaction tube was increased by the thermal expansion of the gas, or the oxidation of the sample, the electric circuit was closed and the motion of the movable furnace was stopped by the action of an electronic relay.



a: CO_2 entry,
b: pressure-regulator, containing water.
c: manometer with platine poles, containing Na_2SO_4 soln.
d: combustion tube,
m_1: fine capillary,
$k_{1,2,3}$: cocks.

Fig. 2.

20. Micro determination of oxygen in organic compounds. I. Preliminary experiments. Tetsuro Kôno, Enoki Hayashi, Michiko Nakayama, Keiko Sato, Mizue Suzuki and Ikuko Isobe (Journ. Agr. Chem. Soc. Japan **28**, 581, 1954)

Micro determination of oxygen after the method of Unterzaucher (Ber. **73B**, 392, 1940) was examined. In the experiment, the carbon monooxide produced was

determined gravimetrically after it was oxidized with copper dioxide heated at 235°, and removed from moisture. It was found that some of the commercial nitrogen contained an appreciable amount of impurities which could not be removed with the reduced copper heated at about 500°, but it was removed when the gas was first oxidized with copper dioxide heated at 500-550°, and then passed through a layer of ascalite.

II. Automatic control of the pyrolysis. Tetsuro KÔNO, Keiko SATO, Mizue SUZUKI and Ikuko ISOBE (Ibid. **28**, 804, 1954)

The pyrolysis of the sample in the micro determination of oxygen was automatized as in the case of the determination of carbon and hydrogen, and nitrogen. The use of the automatic apparatus simplified the procedure, and improved the accuracy of the determinations. But the standard deviation of the determinations were not very satisfactory, namely, 0.34-0.45%.

21. The syntheses of peptides by the phthaloyl method. Part 2. The syntheses of glycyl-peptides and DL-alanyl-peptides. Kyôhei YAMASHITA and Yoshikazu SAHASHI (Journ. Agr. Chem. Soc. Japan **28**, 672-5, 1954)

Several phthaloyl-glycyl- and -DL-alanyl peptides were synthesized by the acylation of amino acids with phthaloyl-aminoacid chloride. In the presence of $NaHCO_3$ phthaloyl aminoacid chloride. In the presence of $NaHCO_3$ phphaloyl aminoacid chlorides reacted with aminoacid in aqueous solution to afford phthaloyl peptides. Utilizing this method the following phthaloyl peptides were synthesized: -glycyl-DL-valine, m.p. 198–198.5°C; -glycyl-DL-leucine, 184.5–185.5°C; -glycyl-L-leucine, 105–6°C; -glycyl-L-glutamic acid, 192.5–193.5°C; -DL-alanyl-DL-valine, 193.5–195.5°C; -DL-alanyl-L-leucine, 91–92°C; -DL-alanyl-DL-phenylalanine, 158–160°C; and -DL-alanyl-DL-glutamicacid, oil. By hydrazinolysis of these pathaloyl peptides, corresponding dipeptides were obtained in high yield.

22. The syntheses of peptides by the phthaloyl method. Part 3. On the modified Schotten-Baumann acylation. Kyôhei YAMASHITA and Mitsuyoshi YASHIRO (Journ. Agr. Chem. Soc. Japan **28**, 674-7, 1954)

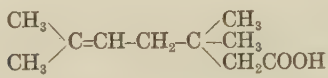
The phthaloyl method for the syntheses of peptides was improved. In the presence of sodium acetate of potassium acetate, phthalimido acyl chloride readily reacted with various amino acid in glacial acetic acid to give corresponding pothaloyl peptides. Using this method the auther synthesized following phthaloyl-derivatives; phthaloyl-glycylanilide, m.p. 231–2°C; -glycyl-glycine 230–231°C; -glycyl-DL-alanine, 221°C; -glycyl-L-leucine, 105–6C°; -glycyl-DL-phenylalanine, 198.5°C; -glycyl-L-phenylalanine, 193–4°C; -glycyl-DL-valine, 198–199.5°C; -glycyl-glycyl-glycine, 231°C; -DL-alanyl-anilide, 162–4°C; -DL-alanyl-DL-alanine, 181–3°C; -DL-alanyl-DL-phenylalanine, 157–9°C; -DL-phenylalanyglycine, 127–9°C; -DL-phenylalanyl-DL-alanine, 198–200°C; -DL-phenylalanyl-DL-phenylalanine, 93–4°C. By hydrazinolysis of these phthaloyl peptides, corresponding peptides was readily obtained in moderate yield.

23. Studies on chrysanthemic acid. Part 1. Syntheses of some related substances of chrysanthemic acid. Masanao MATSUI and Seiichi KITAMURA (Bull. Agric. Chem. Soc. Japan **19**, 42-8, 1955)

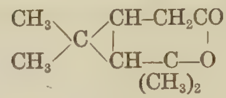
Several new compounds including 2, 5-dimethyl-4-hexenyl-2-oxy-acetic acid (I), an isomer (II) of (±)-cis-dihydrochrysanthemolactone and trans-2,2-dimethyl-3-(1-methyl-1-hydroxyethyl)-cyclopropaneacetic acid (III) were synthesized.

(III) was obtained accompanied with unidentified product $C_{10}H_{16}O_2$ by the reaction of cis-homocaronoanhydride (IV) and methyl magnesium iodide, and expected formation of (±)-cis-dihydrochrysanthemolactone has so far been unsuccessful.

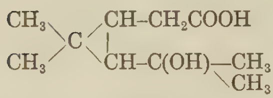
Homocaronic acids were prepared by modified method.



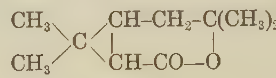
(I)



(II)



(III)



(IV)

24. Studies on chrysanthemic acids. Part II. A separation of (±)-trans-chrysanthemic acid from the mixture of (±)-trans and (±)-cis-chrysanthemic acids. Masanao MATSUI and Masateru MIYANO (Bull. Agric. Chem. Soc. Japan **19**, 159-160, 1955)

Distillation of (±)-trans-hydroxydihydrochrysanthemic acid in the presence of catalytic amount of p-toluenesulfonic acid under reduced pressure (142°C/12 mm Hg) readily affords (±)-trans-chrysanthemic acid in good yield, the former was known to be easily obtained from the mixture of (±)-trans- and (±)-cis-chrysanthemic acid. Thus the above method constitutes a convenient and practical method for separation of mixed chrysanthemic acid.

25. Islanditoxin, a toxic metabolite produced by *Penicillium islandicum* Sopp. Shingo MARUMO and Yusuke SUMIKI (Journ. Agr. Chem. Soc. Japan **29**, [4], 305, 1955)

The toxic substance was isolated in the form of colourless needles from the cultured broth of *Penicillum islandicum* which caused the yellowsis rice, and proposed to name this substance as islanditoxin.

The islanditoxin consisted of C, H, O, N and Cl and melted with decomposition at 250-51°.

Its minimum lethal dose in mice was found to be 3.6 mg per kg subcutaneously. In histopathological examination, it was observed the degeneration of liver cells and strasis of circulating blood in the liver of the mice injected with the crystal of islanditoxin.

26. Studies on a new antibiotic Angustmycin. Hsü YUNTSEN, Hiroshi YONEHARA and Hiroshi UI (Journ. Antibiotics **7** [4], 113, 1954)

The new antibiotic Angustmycin was isolated as a pure crystalline form from the cultural broth.

The antibiotic was absorbed on active carbon from the broth and eluted by 80%

aqueous acetone at pH 2.0 by I–N hydrochloric acid. The eluate was dried up in vacuo and purified by alumina chromatography dissolving in mixture solvent of ethanolbenzol (I–I).

The antibiotic decomposes at 164.5-165.5, exhibits a single intensive maximum of ultraviolet at 260 mμ.

The infrared spectra show characteristic bands of –OH, $-NH_2$, –CO in substituted amide linkage, and adenine base. The antibiotic is soluble in water, methanol, ethanol, pyridin, cyclohexane, and insoluble in other organic solvents.

The antibiotic shows specific activity against mycobacterium but not against other gram positive and negative bacteria, fungi, and yeasts.

The intraperitoneal injection of 2.5 g/kg to mouse did not show any symptom of toxicity.

27. Biochemical studies on "Bakanae" fungus. Part 33. 5-Hydroxymethyl-furan-2-carboxylic acid. Akira KAWARADA, Nobutaka TAKAHASHI, Hiroshi KITAMURA, Yasuo SETA, Makoto TAKAI and Saburo TAMURA (Bull. Agr. Chem. Soc. Japan **19**, 84, 1955)

In the study on the chemical structure of gibberellins, the submerged culture method was applied to obtain a large amount of gibberellins. While isolating them from the medium, a crystal having m.p. 164-5° was obtained and identified to be 5-hydroxymethyl-furan-2-carboxylic acid.

28. Studies on Fungisporin Part II. Kohei MIYAO (Bull. Agr. Chem. Soc. Japan **19**, 86, 1955)

Fungisporin was subjected to acid and alkali hydrolysis and converted to amino acids. These amino acids were identified to be the two amino acids, L-phenylalanine and L-valine. From the results of the quantitative determination of each amino acid and infrared spectrum of the fungisporin, it was revealed that the fungisporin is a polypeptide composed of the same moles of L-phenylalanine and L-valine, and has the following molecular formula, $(C_{14}H_{18}O_2N_2)_x$. This formula completely agreed with that of the derived by connecting same mole of valine and phenylalanine through simple amide linkage to give polypeptide having negligible end groups.

29. Studies on cecum digestion. Part I. On the relation among the composition of the feed, cecal contents and feces of the rabbits. Makoto KANDATSU, Ichiro YOSHIHARA and Tsutomu YOSHIDA (Jap. Journ. Zootech. Sci. **25**, 2-4, 189, 1953)

Cecum contents of three rabbits which were killed at 4 or 8.5 hours after feeding, mere divided into 4 parts and analysed. No difference was found among their compositions. The feces of rabbits, fed on the mixture of wheat bran and hay, were collected daily for 3 or 7 days. Then the rabbits were killed and cecal contents were analysed. The results showed that the cecal contents contain much more crude protein and much less crude fiber and pentosan than those in the feed and feces.

30. On the nutritive value of yeast protein. Makoto KANDATSU and Eiichi MATSUI (Jap. Journ. Zootech. Sci. **26**, 2, 97, 1955)

Studying on the nutritive value of protein of dry yeast (Mycotorula japonica) cultivated in sulfite waste liquor of wood, the authors obtained the following results.

(1) About 95% of total nitrogen in the yeast was extractive and its amount in each solvent was determined to give the following value (% of total nitrogen) respectively: Water 30, dilute alkali 30, dilute alcoholic alkali 20.

(2) As the sole source of protein in the diets, which contained 10 and 15% protein respectively, dried yeast was administrated to young albino rats for 100 days. When their growth was compared with the growth produced by the control diet which contained the same amount of milk casein, yeast protein showed to have lower nutritive value than milk casein in both cases, especially the difference was revealed highly in the 15% protein diet.

(3) The apparent digestibility of crude protein of yeast was within the range of 60-70% and was not so great.

31. Studies on milk coagulating enzymes. I. A colorimetric micro-method for estimating peptic action. Tòmokichi TSUGŌ (Jap. Journ. Zootech. Sci. **25**, 6, 1954)

A colorimetric micro-method for estimating little proteolytic action (pepsin action) contained in milk coagulating enzyme preparations is presented in this paper. The principle of the method consists of causing tyrosine to react, formed by proteolytic action from casein (substrate), with mercuric sulphate and nitrous acid, estimating colorimetrically the reacting coloured substance by a photometer and representing the proteolytic action with γ units of tyrosine from 1 mg of enzyme preparations. By this method, commercial rennets, rennet powders prepared by salting out method, papain and some pepsin preparations were compared with one another in their proteolytic action.

32. On the influence of homogenization on the property of milk. I. Coagulation of milk and fat content of whey. Rinjiro SASAKI and Kyushichi MIYAZAWA (Jap. Journ. Zootech. Sci. **26**, 93, 1955)

In this experiment the authors examined the minimization of fat granules and its effect on casein in the homogenization of milk as to clotting time, curd tension, and fat content of whey.

As the fat granules of milk are minimized by homogenization, they are prevented from being separated as cream.

This is the essential purpose of homogenization. Besides this, the increase of the susceptibility of casein to the action of rennet and pepsin suggests the change of the property of casein.

These effects are attributed to the change of homogenizing pressure, and the temperature accelerates its action.

33. On the reaction between skin collagen and acid or alkali. (Chemical studies on the tanning properties of animal skin.) Rinjiro SASAKI and Yasushi SATO (Journ. Agr. Chem. Soc. Japan **28**, 510, 1954)

As the first problem of the research on the mechanism of the vegetable tanning of animal skin, the acid- or base-binding capacity of skin collagen and vegetable tanned collagen was studied.

The authors separated collagen from skin and bone of the rabbit and measured the change of the concentration and pH of HCl or NaOH solution in the presence of each collagen. Judging from their properties shown by this experiment, skin collagen was almost similar to bone collagen and to cow's hide collagen reported in literatures. It was shown that the isoelectric zone and alkali flat zone were present between pH 4 and 10 and the isoelectric point would be at pH 5.8 on skin collagen, pH 5.2～5.5 for bone collagen.

Moreover, the vegetable tanned cow's collagen was prepared by washing the scratched and teared leather fiber with NaOH and HCl solution, and then with water and ether, and the same experiment was carried out. As a result, it was shown that its amphotelic character was changed—acid-binding capacity was decreased between pH 3 and 4, and base-binding capacity was increased to between pH 7 and 10.

34. Effects of V. B_{12} on the destruction of blood-corpuscle in rat injected with phenylhydrazine. Rinjiro SASAKI, Satoshi ODAGIRI and Jyōji YOSHIDA (Journ. Agr. Chem. Soc. Japan **28**, 684, 1954)

Effects of V. B_{12} and liver extract on the destruction of blood-corpuscle in rat injected with phenylhydrazine were studied. The content of urobilinogen in the excrements was estimated by colorimetric method and the fluctuation of V. B_{12} content in rat liver was determined by EUGLENA method.

Blood-corpuscle of albino rat is destructed by the injection with phenylhydrazine. At that time, the injection of V. B_{12} or liver extract affects on the delay of the destruction of blood-corpuscle, not decreasing the content of V. B_{12} in the liver.

35. Studies on the reaction of Thiobarbituric Acid (TBA) with fat in foods. Part 1. Reaction of TBA with horse fat (A new detective method of horse meat). Masao FUJIMAKI and Satoshi ODAGIRI (Journ. Agr. Chem. Soc. Japan **28**, 963, 1954)

(1) TBA (2-Thiobarbituric acid) test for the determination of the oxidation of milk fat was applied to horse fat. It was found that horse fat showed stronger color reaction than beef tallow or lard.

(2) TBA test was carried out on the fat extracted from horse meat which was mixed with beef to 0, 25, 50, 75 and 100%, and steamed at 100° for 1 hour. Colors produced with TBA by horse fat were lineal against horse fat %.

(3) Linolenic acid showed the highest value in TBA test among C_{18}-fatty acids which seemed to concern with color development in horse meat.

(4) Absorption spectrum (400-600 mμ) of horse fat was the same form as that of C_{18}-unsaturated fatty acid, and the maximum absorption was found at 535 mμ.

(5) TBA and peroxide values of oleic, linoleic and linolenic acids were determined daily during autoxidation. TBA value increased with peroxide value in linolenic acid, but it remained about same in spite of the increase of peroxide value in oleic acid and linoleic acid.

(6) It was confirmed that compounds producing the colour in TBA reaction with horse fat are linolenic acid and its oxidation products.

(7) This test seems to be applicable for the detection of horse meat in beef products.

36. Studies on the reaction of Thiobarbituric acid (TBA) with fat in foods. Part 2. Reaction of TBA with oxidized milk fat. Chōten INAGAKI, Keiko TARAO and Masao FUJIMAKI (Journ. Agr. Chem. Soc. Japan **28**, 967, 1954)

(1) After a procedure for application of Thiobarbituric acid (TBA) test to milk fat was examined, TBA values of several kinds of milk products were measured.

(2) Sweetened milk products which showed high TBA value were found to have influenced by added sucrose content.

(3) The influences of the methods of storage of modified powdered milk enriched with vitamin A on oxidation of milk fat and retention of vitamin A were studied. It was found that aeration (oyygen) had more influence on oxidation of fat in powdered milk than temperature. On the contrary, the former was less influential on retention of vitamin A than the latter.

37. Studies on the changes of milk fat by *Penicillum roqueforti*. (1) On the liberation of volatile fatty acids from milk fat and their decomposition. Tsuneaki IMAMURA, Yoshie SAITO and Tomokichi TSUGO (Journ. Agr. Chem. Soc. Japan **29**, 261, 1955)

Accumulation of volatile fatty acids in Roquefort cheese is related to hydrolysis of milk fat and their decomposition by *P. roqueforti*. From this point, we have performed the following experiments on:

(1) The relation between the accumulation of volatile fatty acids in media and hydrolysis of milk fat by *P. roqueforti*.

(2) The decomposition of individual volatile fatty acids by *P. roqueforti*.

(3) The production of individual volatile fatty acids from higher fatty acids by *P. roqueforti*, and

(4) The effect of sugar added to media on the (1) and (2).

Results obtained are summarized as follows:

(1) *P. roqueforti* could hydrolyse the milk fat in CZAPEK's solution and consume the fatty acids which had been liberated from milk fat. Lower fatty acids were more markedly decomposed by *P. roqueforti* than the highers and caprylic and capric acids were almost not decomposed.

(2) When sugars did not present in media, volatile fatty acids were more strongly decomposed by *P. roqueforti*.

(3) Of the soluble volatile fatty acids, n-butylic was less decomposed than the others.

(4) Volatile fatty acids did not accumulate from higher fatty acids in media.

From the above results, the authors considered that the liberation of volatile fatty acids which constitute the triglycerides and their decomposition give effect on the accumulation of volatile fatty acids in media or Roquefort cheese.

38. Studies on the changes of milk proteins by *Penicillium roqueforti* (1). Part 1. On the decomposition of milk proteins, changes of nitrogen distribution and effects of lactic acid bacteria. (1). Tsuneaki IMAMURA and Tomokichi TSUGO (Journ. Agr. Chem. Soc. Japan **29**, 265, 1955)

Flavor and body of cheese are attributed to hydrolysis of milk proteins during the period of ripening. The milk proteins in Roquefort cheese are hydrolysed by

rennet, lactic acid bacteria and *P. roqueforti.* These facts give effects to the nitrogen distribution in cheese. From these points, we have performed the following experiments:

(1) On the decomposition of skim milk proteins by 6 strains of *P. roqueforti.*

(2) On the decomposition of casein in synthetic media inoculated with *P. roqueforti* No. 1006.

(3) On the comparison of decomposition of casein, albumin and globulin prepared from skim milk by *P. roqueforti* No. 1006.

(4) On the effects of lactic acid bacteria on the decomposition of skim milk proteins and on the growth of *P. roqueforti.*

(5) On the effects of rennet on the decomposition of skim milk proteins, and

(6) On the changes of nitrogen distribution in cheese, as determined by WASTNEY and BORSOOK's method.

Results obtained are summarized as follows:

(1) Of the individual skim milk protein, albumin was most easily decomposed, casein was next and globulin was less decomposed than the above two. But changes of casein seemed to give significant effects to these of milk proteins.

(2) In the cheese curd inoculated with *P. roqueforti,* ratio of soluble nitrogen to total nitrogen increased and to soluble protein nitrogen decreased. Especially, increase of proteose nitrogen was more remarkably than others.

(3) Skim milk protein was not decomposed by Str. lactis. But growth of *P. requeforti* in skim milk medium was accelerated in the case of symbiosis of this bacterium.

(4) Milk protein which had been subjected to the action of rennet, was remarkably decomposed by *P. roqueforti.*

39. Studies on the changes of lactose by *Penicillium roqueforti.* Part 1. On the growth of *Penicillium roqueforti,* decomposition of lactose by *Penicillium roqueforti* and effects of lactic acid bacteria. Tsuneaki IMAMURA, Minoru TANAKA and Tomokichi TSUGO (Journ. Agr. Chem. Soc. Japan **29**, 269, 1955)

Growth of *P. roqueforti* is intimately connected with the consumption of various milk components which attribute to body and flavor of Roquefort cheese. The growth is accelerated in the case of symbiosis of lactic acid bacteria. Because of this, the authors have considered that increase of acidity in cheese curd gives desirable effects on the growth of *P. roqueforti.* In order to obtain the obvious knowledge about this, the authors have performed the following experiments:

(1) On the consumption of glucose, galactose and lactose in synthetic media as the carbon source of *P. roqueforti.*

(2) On the effects of symbiosis of Str. lactis on the consumption of lactose by *P. roqueforti* and its growth.

(3) On the changes of acidity and amount of lactic acid in skim milk media by *P. roqueforti* and Str. lactis, and

(4) On the availability of lactic acid by *P. roqueforti* as carbon source.

From the results obtained from these experiments, the authors have considered as follows:

Lactose is almost not consumed by *P. roqueforti,* as compared with glucose or

galactose. But in the case of symbiosis of lactic acid bacteria, lactose is remarkably consumed. This is owing to the following effects:

(1) Lactose is consumed by lactase secreted from lactic acid bacteria and results in glucose and galactose which are more easily consumed by *P. roqueforti.*

(2) Lactose is also hydrolysed by lactic acid produced from lactose and gives same effects as (1) on the consumption of lactose by *P. roqueforti.*

Lactic acid is consumed by *P. roqueforti* as in the case of volatile fatty acids. In the case of cheese, the pH value of cheese curd in the period of ripening depends upon the amounts of these acids and bases produced from milk proteins by *P. roqueforti.*

40. The effect of treatments with ion-exchange resin on heat coagulation of milk. Rinjiro SASAKI, Tomokichi TSUGO and Arinobu YAJIMA (Journ. Agr. Chem. Soc. Japan **29**, 288, 1955)

(1) The commercial cation exchange resin used in this study was shown to have a usable maximum capacity amounting to 0.587 g of calcium per 20 g of resin. The procedure of Ca→Na regeneration of the exchange resin adsorbing calcium was tested, and it was found that the indirect procedure in which the regeneration was done in the way of Ca→H→Na with HCl and NaCl solution was more profitable than the direct one with NaCl solution alone.

(2) In respect of a salt solution mixed at the same rate as mineral salts in milk, experiments of the exchange resin treatments were performed. It was found that calcium was preferentially exchanged close to the theoretical value and there was hardly any effect of other cations.

(3) Experiments for treating milk with the exchange resin were carried out concerning the relations between volume of milk, velocity of the flow, acidity and pH of the milk, and the rate of calcium removed. It was shown that the higher the rate of calcium removed, the lower the temperature of heat coagulation of treated milk, whereas the opposite cas was existed in a special example.

41. The relationship between calcium in milk and rennet coagulation. Rinjiro SASAKI, Tomokichi TSUGO and Shuryo NAKAI (Journ. Agr. Chem. Soc. Japan **29**, 292, 1955)

With respect to the procedure of removing soluble calcium from milk as insoluble salts, experiments were performed with skim milk, and it was seen that oxalate was able to be adapted for the purpose while sulfate was unsuitable. Then by means of potassium oxalate, decalcified milk was obtained from skim milk, from which calcium was removed in various proportions and its coagulability by rennet was experimented precisely.

As a result it was found that (a) there was a parabolic relation within a certain limit between the rate of decalcification of milk and coagulation times by rennet, (b) by removing 20 to 25% of total calcium in milk, the milk should become practically not coagulable by rennet, and (c) by adding soluble calcium salts to the decalcified milk, its coagulability was recovered and in these relations calcium acted quantitatively as for milk coagulation.

42. Studies on the induced mutation of *Aspergilli* by ultraviolet irradiation. Kin-ichiro SAKAGUCHI, Isamu SUZUKI and Hiroshi IIZUKA (Journ. General and Applied Microbiology **1** [2], 164, 1955)

(1) Eleven strains of typical *Aspergillus* species were irradiated with ultraviolet rays. The authors obtained the Albino type mutants from 8 of them, i.e. *A. nidulans, A. oryzae, A. tamarii, A. terreus, A. giganteus, A. fumigatus, A. ochraceus, A. wentii.*

(2) From *A. candidus* no color mutants were obtained. The green or bluish species never produce black mutants and from the black species no green or bluish mutant.

(3) Color mutants of conidial heads obtained from each strain were classified into 8 types; i.e. Black, Brown, Cinnamon, Buff, Albino, Yellow, Yellowish Green, and Green.

(4) The mutants obtained were classified also from the characteristics other than the color of conidial heads, that is, from the size of conidial heads, the pigment on the reverse of colonies, and the appearance of mycelia.

(5) The sclerotia producing mutant has been prevalently obtained from *A. tamarii* and *A. ochraceus.*

(6) The correlations were discussed between the classification of *Aspergillus* species and the tendencies of colorations of their color mutants.

43. A study on the nature of conidiophore-walls of *Aspergillus oryzae* and *Asp. sojae*. Kin-ichiro SAKAGUCHI and Hiroshi IIZUKA (Journ. Agr. Chem. Soc. Japan **27**, 402, 1953)

As for the conidiophore-walls of *Asp. flavus-oryzae,* THOM and CHURCH[1] (1921) pointed out that "stalk walls when examined with low magnification are often recorded as delicatley rough, and conidia as delicatley rough or spiny. Careful examination with high power shwos these appearances to be due to pits".

One of the present authors [2] (1933), on his taxonomic studies upon *Asp. oryzae* strains, has found that conidiophore-walls of some members of these yellow green Aspergilli, especially those used in Soy sauce or Tamari Soy sauce making, are seen to be quite smooth with ordinary or low magnification. SAKAGUCHI and YAMADA[3] (1944) have proposed a new classification dividing these strains into two main groups; i.e. (I) *Asp. oryzae* s. str. SAKAGUCHI and YAMADA or synonimous with *Asp. flavus-oryzae* THOM and CHURCH, and (II) *Asp. sojae* nov. sp. S. and Y.

As for the conidial walls of the both species, SAKAGUCHI and IIZUKA[4] (1949) pointed out that "the both species gave equally echinulate appearance of the same nature on their conidial walls, except that those of *Asp. sojae,* have somewhat higher echinulation than the other in the extent of 0.2 microns or higher which is within the limit of the resolution power of optical microscope".

The present authors succeeded to show the electron micrographs of conidiophore-walls of the both species. As shown in the figures, the surface of conidiophore-walls

(1) THOM and CHURCH: *Amer. J. Bot.*, VIII, 106 (1921).
(2) SAKAGUCHI, K.: Jôzôrombunshu III, 247 (1933).
(3) SAKAGUCHI, K. and YAMADA, K.: *J. Agr. Chem. Soc. Japan*, XX, 65 (1944).
(4) SAKAGUCHI, K. and IIZUKA, H.: *J. Agr. Chem. Soc. Japan*, XXIII, 100 (1949).

of the new species, *Asp. sojae* is apparently smooth, while that of *Asp. oryzae* is provided with numerous projections, ranging from 0.24 to 0.08 microns in height.

44. The taxonomic studies upon the strains NRRL No. 337 and No. 330. Kin-ichiro SAKAGUCHI and Hiroshi IIZUKA (Journ. Chem. Soc. Japan **27**, 524, 1953)

The authors received two industrially important strains of *Asp. niger* group, NRRL No. 330 and No. 337, from Professor K. B. RAPER. The general impressions of those strains seemed to be very near to those of Kuro-koji-molds[1], the black *Aspergilli*, which are widely used for manufacturing a kind of distilled wine from sweet potatoes in the southern districts of Japan. As for the morphological characteristics of those Kuro-koji-mold distinguished from the ordinary *Asp. niger* VAN TIEGHEM strains, the authors have already[2] pointed out that the conidial surfaces are rather smooth, rough or very rarely somewhat echinulate through the optical microscope while the latter when mature are conspicuously echinulate which were expressed as colored bars according to THOM and RAPER[3].

As it is shown in the electron microscopic figures 1, 2 and 3 the surfaces of the conidial walls of NRRL No. 337 and No. 330 have so-called typical rough appearance while those of *Asp. niger* 2126 are provided with distinct processes, ranging from 0.7 to 1.0 microns in length. As for the conidial wall of *Asp. niger*, THOM and RAPER[4] described that "rough or spinulose from coloring substance deposited as tubercles, bar or loops between the outer primary wall and the inner or secondary wall". But in the present electron micrographs these processes are not able to attribute to the colored loops at least.

According to the classification proposed by the authors[5] the strain NRRL No. 337 may be classified as *Asp. aureus* var. *brevius* NAKAZAWA et al.[6] from the following morphological characteristics; i.e. the conidial surface almost smooth through the optical microscope, the primary sterigmata under 10 microns in length, the conidial heads small and blackish brown shade in color, the conidiophores short, and the nitrite assimilation test positive. Secodly the strain NRRL No. 330 may be classified as *Asp. saitoi* var. *kagoshimaensis* SAKAGUCHI et al.[7] from the following morphological characteristics; i.e. tre conidial surface almost smooth through the optical microscope, short sterigmata about 10 microns in length.

Amylase producing abilities of "*Asp. niger*" NRRL No. 330, No. 337 and *Asp. oryzae* NRRL No. 692 were compared with several strains of Japanese potent amylase producers. When cultivated on wheat bran both "*Asp. niger*" NRRL No. 330 and No. 337 produce the amylase system of *Asp. usamii* type[8] and their activities are 6/7 and 1/2, respectively, of that of *Asp. usamii* R-0635. Amylase system of *Asp. oryzae* NRRL No. 692 belongs to "*Asp. oryzae* type" and its activity is about 7/10 of that of Asp. oryzae S-7[9] and about 1.4 times higher than those of *Asp. oryzae* M 2-1 or S 1-1.

(1), (2), (5), (7) K. SAKAGUCHI, H. IIZUKA and S. YAMAZAKI: *J. Applied Mycology* (Univ. of Hokkaido), III, 53, 65 (1949); III, 97, IV, 1 (1950); *J. of Agr. Chem. Soc. Japan*, XXIV, 138 (1951).

(3), (4) Ch. THOM and K. B. PAPER: A Manual of the Aspergilli (1945).

(6) R. NAKAZAWA et al.: *J. Agr. Chem. Soc. Japan*, XII, 931 (1936).

(8) H. OKAZAKI: *J. Agr. Chem. Soc. Japan*, XXIV, 88 (1950).

(9) K. SAKAGUCHI and K. YAMADA: *J. Agr. Chem. Soc. Japan*, XX, 65 (1944).

45. Studies on Aspergillus usamii mut. shirousamii and its industrial application. Hiroshi IIZUKA and Tatsuro YAMAGUCHI (Journ. Agr. Chem. Soc. Japan **28**, 972, 1954) (Journ. General and Applied Microbiology **1**, [3], 1955)

(1) Studies were made concerning the morphology and classification of a strain whose conidial heads color was light pinkish cinnamon. This strain was selected from mutants obtained by giving *Asp. usamii* R-0635 ultra-violet irradiation; it was named *Aspergillus usamii mut. shiro-usamii.* (the prefix "shiro" means white).

(2) By further ultra-violet irradiation of this strain an albino type was obtained.

(3) Combination of pairs of all mutants obtained, as well as pairs of mutants with the parent and with other typical Aspergillus strains, were tested for heterocaryosis as shown by the color of conidial heads. Formation of heterocaryotic conidial heads was observed between the tan mutant (*Asp. usamii mut. shiro-usamii*) and the brown mutant, between the tan mutant and *Asp. usamii,* and between the brown mutant and *Asp. usamii.*

(4) Amylolytic and acid producing powers of *Asp. usamii mut. shiro-usamii* were found to be as good as those *Asp. usamii,* or better.

(5) Favorable results were obtained in tests of an industrial application of *Asp. usamii mut. shiro-usamii* for a new type of practical alcoholic fermentation by the Koji method. Therefore this mutant is better for practical application when used with *Asp. oryzae* because the mutant has the same features as *Asp. usamii* but it is not black.

46. Study on the morphology and classification of the violet-black *Aspergilli* Part 1, Part 2. Hiroshi IIZUKA (Journ. Agr. Chem. Soc. Japan **27**, 801 and 806, 1953)

The author collected about 3,500 samples of soils, cereals and many kinds of agricultural and aquatic products from many districts in Japan, and isolated 47 different strains of *Aspergilli,* which were characterized giving violet-black colonies, and carried out morphological and taxonomical studies on them together with 2 strains of *Asp. japonicus* SAITO and 1 strain of *Asp. violaceofuscus* GASPERINI NRRL 360.

One new species, *Asp. aculeatus* (6 strains), two new varieties, *Asp. japonicus* var. *viridiflavus* (5 strains) and *Asp. japonicus* var. *atrofuscus* (1 strains), were isolated among them along with 35 strains of *Asp. japonicus.*

Accordirg to THOM and PAPER(1), *Asp. japonicucs* together with *Asp. luchuensis* and *Asp. violaceo-fuscus* were classified into the group of *Asp. niger* or the black *Aspergilli,* which were divided into two main subgroups by the arrangements of sterigmata, single or double series. According to INUI's original description(2), *Asp. luchuensis* produces hands with single sterigmata exclusively.

K. SAKAGUCHI and the present author(3) have, however, pointed out that 3 strains of *Asp. luchuensis* in the collection of Institute for Fermentation (in Osaka) and Department of Agricultural Chemistry, Univ. of Tokyo, are all provired with double sterigmata predominantly an dsingle or mixed sterigmata partly or very rarely. Also

(1) Ch. THOM and K.B. PAPER: A manual of the *Aspergilli* (1945).

(2) T. INUI: *J. Col. Sci. Imp. Univ. of Tokyo,* XV, 456 (1901).

(3) K. SAKAGUCHI, H. IIZUKA and S. YAMAZAKI: *J. of Applied Mycology* (Univ. of Hokkaido) III, 53, 65 (1949); III, 97; IV, 1 (1950); *J. of Agr. Chem. Soc. Japan,* XXIV, 138 (1951).

Asp. violaceo-fuscus occasionally has double sterigmata as observed on NRRL No. 360 which the author received from Dr. K. B. Raper in Oct. 1948. All the strains of *Asp. japonicus* and 47 strains in this experiment had, however, sterigmata in one series.

As it was shown in the electron micrographs, the surfaces of the conidial wall of *Asp. japonicus* and these 47 strains were provided with densely aculeate prcoesses, while those of *Asp. luchuensis* and *Asp. violaceo-fuscus* were rough and somewhat roughened.

Colonies of *Asp. japonicus* and these 47 strains were characterized by their violet-black heads, but those of *Asp. luchuensis* are brownish olive and of *Asp. violaceo-fuscus* NRRL No. 360 are light purple drab.

It is, therefore, conspicuous characteristics of *Asp. japonicus* and these 47 strains that they produce exclusively violet-black conidial heads with single sterigmata and conidia which possess aculeate processes over the surface.

From the points mentioned above it seems to be unsuitable to sum up *Asp. japonicus* and these 47 strains in *Asp. luchuensis* series together with *Asp. luchuensis* and *Asp. violaceo-fuscus*, and it is not appropriate to put these "violet black *Aspergilli*" in *Asp. niger* group with *Asp. carbonarius* series and *Asp. niger* series. This is why the author has proposed here to classify them in the new "*Asp. japonicus* group." The above relations are shown in the following key.

A key for the classification of the violet black *Aspergilli*.

I. Sterigmata in two series.
    A. Conidia more than 5 μ in diameter .... *A. carbonarius* group.
    B. Conidia mostly less than 5 μ in diameter.
        1. Conidial wall distinctly echinulate when mature ...... *A. niger* group.
        2. Conidial wall smooth, rough or rarely echinulate. . Kuro-Koji mold group.
II. Sterigmata in one series, conidial wall densely aculeate ... *A. japonicus* group.
    A. Conidia strongly elliptical 4.0-6.5 $\times$ 2.8-3.2 μ, vesicle 50-80 μ, conidiophores long 3-4 mm .... *A. aculeatus* sp. nov.
    B. Conidia globose 3.0-5.0 μ, vesicle 25-45 μ, conidiophores short 0.5-1.0 mm.
        1. Colonies in violet brown shades.
            a. Reverse colorless or light vinaceous .... *A. japonicus* Saito
            b. Reverse and media dark greenish yellow .... *A. japonicus* var. *viridiflavus* var. nov.
        2. Colonies in fuscus-black shades .... *A. japonicus* var. *atrofuscus* var. nov.

47. Metabolism of aromatic compounds by microbes. Part 4. Factors influencing adaptive enzyme formation of m-hydroxybenzoic acid and gentisic acid splitting enzymes by *Pseudomonas ovalis* var. S-5. Kei Arima, Kazuo Komagata, Shin-ichi Sugiyama, Masazi Kazama and Keiji Yano (Bull. Agri. Chem. Soc. Japan **19**, [1], 51, 1955)

For the elucidation of oxidation of m-hydroxybenzoic acid and oxidative splitting of gentisic acid by *Pseudomonas ovalis* var. S-5, various factors necessary for the active formation of the adaptive enzymes were examined; i.e. the method of adaptation, the effect of the substrate concentration, the effect of time required for

adaptation, and the effect of the energy source in secondary adaptation procedure, and optimum conditions for each of the factors were determined.

The factors influencing the formation of adaptive enzymes, m-hydroxybenzoic acid oxidase and gentisase, in the secondary adaptation procedure by the non-proliferating cells of *Pseudomonas ovalis* var. S-5 were examined and the following results obtained.

(1) The addition of m-hydroxybenzoic acid to the culture media, at the time of initiation of incubation and at three hours before the harvest of the cells, decreases the time required for adaptive enzyme formation in the secondary adaptation, i.e., in the former case 1 to 2 hours and in the latter case 0 to 1 hour is enough for the completion of the induction of both enzymes.

(2) The optimum length of time required for the completion of the induction of both enzymes under the standard conditions of the secondary adaptation procedure was approximately three hours.

(3) The optimum concentration of substrate, *m*-hydroxybenzoic acid, in the secondary adaptation procedure was M/100 for *m*-hydroxybenzoic acid oxidase and M/200 for gentisase.

(4) No effect of the addition of glucose as the energy source upon the induction of gentisase and m-hydroxybenzoic acid oxidase was recognized with the cells adapted for three hours in the shaking flask or with the cells grown in bouillon glucose medium. However, the effect was recognized with the cells adapted for one hour in shaking flasks or with the cells adapted in Warburg vessels.

48. Metabolism of aromatic compounds by microbes. Part 5. Factors influencing adaptive enzyme formation of m-hydroxybenzoic acid and gentisic acid splitting enzymes by *Pseudomonas ovalis* var. S-5. Kei ARIMA, Kazuo KOMAGATA, Masazi KAZAMA, Shin-ichi SUGIYAMA and Keiji YANO (Bull. Agr. Chem. Soc. Japan **19**, [1], 61, 1955)

For the elucidation of oxidation of m-hydroxybenzoic acid and oxidative splitting of gentisic acid by *Pseudomonas ovalis* var. S-5, various factors necessary for the adaptive formation of the enzymes, i.e., effect of the age of the culture, effect of oxygen, and effect of inhibitory reagents such as streptomycin, acid, and dinitrophenol against the formation of the adaptive enzymes, were examined. Optimum conditions for each of the above mentioned factors were determind.

Based on the fundamental conditions determined in the former part of this report on the adaptive enzyme formation of the nonproliferating intact cells in the secondary adaptation procedure, further investigations of the influence of the factors i.e. the age of the culture, method of supplying oxygen, and use of inhibitor against the induction of the adaptive formation of m-hydroxy-benzoic acid oxidase and gentisase, were examined and the following results were obtained.

(1) The growth curve of *Pseudomonas ovalis* S-5, on both bouillon and bouillon glucose medium in shaking culture was obtained.

(2) The adaptability of the intact cells prepared from the lag phase, biologically young phase, and log phase were weak and cells from the beginning to almost the end of the stationary phase exhibited the shortest lag time and highest QO_2 value. The old cells were very weak in adaptability.

(3) Among the different methods of supplying oxygen in the course of the secondary adaptation procedure, i.e. oxygen gas bubbling, vigorous aeration by a compressor, and aeration through an ordinary cotton plug in shaking culture, no remarkable differences between them were observed in the rate of adaptive enzyme formation of both enzymes. Nitrogen gas bubbling, that is anaerobic conditions, completely suppressed the formation of adaptive enzymes.

(4) Streptomycin at a concentration of 10^{-4} M and 10^{-3} M a slightly higher concentration than the minimum inhibitory concentration of this organism, when added at the start of adaptation, completely suppressed the enzyme formation, however, once initiation of the adaptive enzyme formation had begun, streptomycin does not exhibit any inhibitory activity at all towards the formation of enzymes or towards the activities of the two enzymes.

49. Degradation of D-glutamic acid in Bacterium. Kazuo IZAKI, Hajime TAKAHASHI and Kin-ichirô SAKAGUCHI (Journ. Agr. Chem. Soc. Japan **29**, [2], 176, 1955)

A bacterium which can metabolize D-glutamic acid more rapidly than L-form was isolated from the soil. L-glutamic acid was successfully obtained from DL-form by decomposing D-glutamic acid using this strain. D-glutamic acid is oxidized some ten times faster than L-form by the cell grown aerobically in the medium contained DL-glutamic acid as a sole source of carbon and nitrogen.

Noteworthy is the observation that considerable amount of L-glutamic acid was produced from D-glutamic acid. This may be explained either by the presence of glutamic racemase or the synthesis of L-glutamic acid from D-form. The organism grown aerobically in the usual broth cannot oxidize D-glutamic acid. Probably the enzyme responsible for the oxidation of D-glutamic acid may be adaptive in nature.

50. Studies on the production of a white crystal "Glauconic acid" and red pigments by *Penicillium purpurogenum*. Matao TAKASHIMA, Akira KITAJIMA and Kenichi OTSUKA (Journ. Agr. Chem. Soc. Japan **29**, [1], 1955)

A strain was found to produce a white crystal "Glauconic acid" and it was found that, from morphological and biological aspects, the strain belongs to *Penicillium purpurogenum*. This strain grew well in the glucose-CZAPEK's medium in surface and submerged cultures, and produced white crystals accompanied by red pigments. This white crystals and pigments were precipitated from culture filtrate by acidifying with mineral acid.

The crude precipitate was extracted with aectone and from this solution white crystals of needle-like prism were obtained. The melting point of the crystal recrystallized from chloroform and aqueous acetic acid was 200.5-201.5° (obsd.). From the data of elementary analysis and molecular weight measurement the molecular formula must be $C_{18}H_{20}O_7$.

The physical and chemical characters of the white crystal and the melting point of its acetylated compound showed the same experimental results as those characters of glauconic acid. When this white crystal was mixed with glauconic acid there was no change in melting point, and the infra-red absorption spectrums showed complete identity. From these experimental results the authors concluded that this white

crystal is identical with glauconic acid of WIJKMANN et al., originally found in cultures of a *Penicillium glaucum.*

51. Studies on a new antibiotic Angustmycin, II. Heiichi SAKAI, Yünsten HSÜ and Fujio ISHIKAWA (Journ. Antibiotics Ser. A. **7**, [4], 116, 1954)

It was reported in another paper that the actinomycete strain No. 6A-704 produces a new antibiotic named Angustmycin. The purpose of this paper is to discuss the results of the experiments concerning the composition of media for production of Angustmycin and the taxonomic studies of 6A-704 strain.

For the production of Angustmycin, the medium containing starch, ammonium sulphate, dry yeast and inorganic salts, was proved to be most suitable. It is possible to increase the final yield of antibiotic by using concentrated medium.

The angustmycin-producing strain, 6a-704, was identified as *Streptomyces hygroscopicus.*

Angustmycin differs from hydroscopin which had been reported as a antibiotic produced by *St. hygroscopicus* comparing their antibiotic spectra.

52. Studies on the submerged amylase production. Part 6. The variation of amylase formation by black *Aspergilli* in acidic media and in neutral media. Yasuji MINODA, Koya MOGI and Tetsuo NAKAMURA (Journ. Agr. Chem. Soc. Japan **29**, 115, 1955)

The authors investigated the variation of submerged amylase formation by Black *Aspergilli* in acidic media (added 0.2% of ammonium sulphate; pH of these media was kept at about 2.4 during the incubation) and neutral media (added 0.3% of calcium carbonate to acidic media; pH of these media was kept at about 6.0). In acidic media (Fig. 1) dextrinizing amylase did not appear, but after the weight of mycelium reached to maximum saccharogenic amylase and maltase remarkably increased and saccharifying power came to surpass 40%. Saccharifying power in mycelium was low, but maltase activity in mycelium was considerably high. As

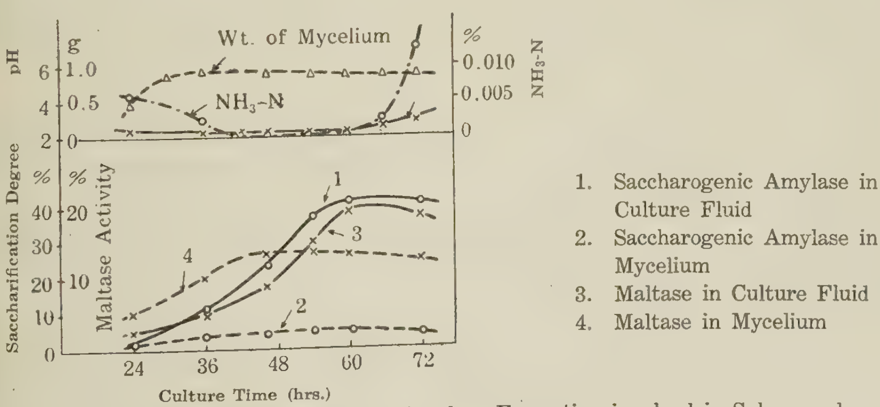


Fig. 1. Chemical Changes and Amylase Formation involved in Submerged Mold Culture of *Asp. awamori* var. *fumeus* in Acidic Media.

fungal saccharogenic amylase has maltase activity, maltase activity in culture fluid is given by this enzyme, but maltase activity in mycelium may be given by other enzyme. In neutral media (Fig. 2) dextrinizing amylase was high, but increase of

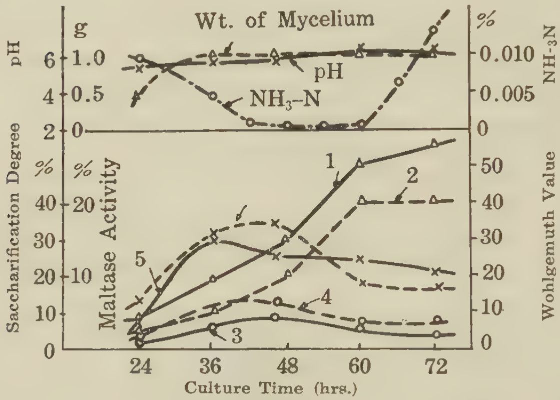


Fig. 2. Chemical Changes and Amylase Formation involved in Submerged Mold Culture of *Asp. awamori* var. *fumeus* in Neutral Media.

saccharogenic amylase found in acidic media did not occur and saccharifying power stayed under 10%. Maltase was formed in early period of incubation and decreased gradually.

Since dextrinizing amylase (α-amylase) is inactivated at pH 2.4, so it was a matter of course that this amylase did not appear in acidic media. But the low activity of saccharogenic amylase in neutral media can not be interpreted by inactivation, for the saccharogenic amylase is stable at pH 6.0. Ca'' ion also did not inhibit the formation of this enzyme and the weight of mycelium was nearly equal in both media. So we concluded that the acidic cultural environment is necessary for the formation of saccharogenic amylase.

The strains for submerged mold amylase belonging to *Asp. Usamii* group, *Asp. awamori* group and *Asp. niger* group have this property. But *Asp. oryzae* did not grow sufficiently in acidic media and saccharifying power was as low as in neutral media.

53. Studies on the continuous fermentation. Part 4. Effect of submerged mold culture on yield of alcohol from acid-hydrolyzed mashes. Kiyomoto UEDA (Journ. Agr. Chem. Soc. Japan **29**, 101, 1955)

Experiments were conducted chiefly to find the solution to the following problems, i.e., the cause of low alcohol yield and the role of submerged mold culture as a yield factor in fermentation of acid-hydrolyzed sweet potato mash. From all the relevant experimental evidences, following facts were found.

The cause of low alcohol yield is due to the large quantities of unfermentable sugars produced secondarily during the acid hydrolysis.

The phenomenon that the addition of submerged mold culture as a fermentation supplement increasing the alcohol yield were illustrated as follows. The dextrins left in the mash hydrolyzed incompletely are converted into fermentable sugars by

the saccharogenic amylase system contained in added mold culture and are fermented to alcohol. Therefore, in the case of complete acid hydrolysis, the addition of mold culture to the hydrolyzed mash does not give any effect on the alcohol yield of the fermentation.

54. **Studies on the continuous fermentation. Part 5. Laboratory continuous alcoholic fermentation of acid-hydrolyzed mashes.** Kiyomoto UEDA (Journ. Agr. Chem. Soc. Japan **20**, 105, 1955)

The work reported here was directed chiefly to determine the degree of adequate hydrolysis of acid-hydrolyzed sweet potato mash in order to get high alcohol yield as much as that of enzyme converted mash, to employ a continuous system consisted of two fermentors in series, and to determine the minimum quantity of submerged mold culture as a fermentation supplement required for the fast continuous fermentation.

It was found that the 70% hydrolyzed mash showed the maximum alcohol yield, viz., the fermentation efficiency reached to 90% in the batch fermentation, and 88% in the continuous fermentation (30 hours cycle time), by adding the submerged mold culture as much as 20% of the mash in volume. In the case of 90% and 95% hydrolysis degree, fermentation efficiencies decreased to 85% and 80% respectively.

The optimum quantity of mold culture to be added to the fermentation was found to be about 10%. It was also possible to replace the submerged mold culture by Takadiastase solution which possesses the same amylase activity.

From the results mentioned above an example of the continuous fermentation scheme of acid-hydrolyzed sweet potato mash was given (Fig. 1).

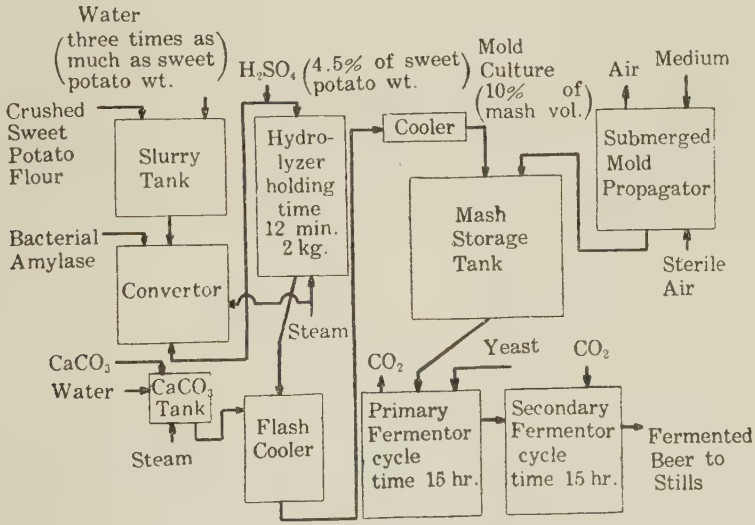


Fig. 1.

III. Agricultural Economics

Abstract No. 55

55. Production Function in Japanese Agriculture. Keizo TUTIYA (Nogyo Sogo Kenkyu, Quarterly Journal of Agricultural Economy, No. 1, 1955)

Recently a group of students of the Japan Agricultural Economic Society have taken up the problems of "under-employment and capital-rationing", in Japanese Agriculture, in such a way as instituted by Shultzians, employing the tools of modern economics for the analysis of agricultural problems. But it is regrettable indeed that the economic research in this line has not been done at all before these discussions were initiated, and accordingly it has not been clarified substantially whether or not, in the agriculture of Japan, characteristics as they have in the United States, have also existed in the same typical form.

In order to make up such deficiencies, I tried estimating the marginal productivity of agricultural resources in terms of production function and also made an extensive study of under-employment and capital-rationing in agriculture. Data that served as basis for this purpose came from the survey of the cost crops, including rice, barley, wheat sweet-potatoes, tea and orange produced in Shizuoka prefecture for the year of 1951. The type of production function, which I employed, was,

$$P=bT^{\alpha}L^{\beta}C^{\gamma}$$

where, P indicates farm products, T area of land, L labor hours measured in adult unit, C total capital value, α, β and γ parameters to estimate.

After this procedure, I was able to draft Table 1, Table 2, and Table 3 in the following forms, and those enabled me to point out the following facts:

(1) The marginal productivity of labour in the production of tea and sweet-potato crops led to figures with a little higher than the average agricultural wages, but those of barley and orange were both zero, while that of wheat showed negative.

Table I.
Elasticities

	α Land	β Labor	γ Capital
Rice	0.56[a]	0.19[c]	0.25[c]
Barley	1.31[a]	−0.17[d]	−0.03[d]
Wheat	1.23	−0.36	−0.002[d]
Sweet-potato	0.88	0.27	−0.002[d]
Tea	0.29[a]	0.30[a]	0.46[a]
Orange	1.00[a]	0.03[d]	0.07[d]

a significant at 1 percent level,
b significant at 5 percent level,
c significant at 10 percent level,
d non-significant at 40 percent or more level.

Table 2.
Adjusted Elasticities

	Land	Labor	Capital	Total	R
Rice	0.56	0.19	0.25	1.00	0.89
Barley	1.10	0	0	1.10	0.93
Wheat	1.23	−0.36	0	0.87	0.95
Sweet-potato	0.85	0.29	0	1.14	0.94
Tea	0.29	0.30	0.46	1.05	0.90
Orange	1.06	0	0	1.06	0.93

the table has rejected those that data have a non-significant coefficent at 40 percent or more level.

Table 3.
Marginal Productivity

	Land	Labor	Capital
	per 0.01 ton	per 1 hour	per ¥100
Rice	83	11	41
Barley	59	0	0
Wheat	119	−14	0
Sweet-potato	181	34	0
Tea	115	29	51
Orange	792	0	0

(2) Comparing the marginal productivity of labour in farm sector with that of cotton industry belonging to non-farm sector, rice and sweet-potato crops revealed a rise 5.6 per cent and 18.3 per cent, respectively. Discrepancy of marginal productivity of labour existing between the sector of farm and non-farm became wide to a considerable degree. Under these circumstances, the problems of under-employment in farm sector could be worked out only by a possible policy striving the expansion of industries in the non-farm sector.

(3) The marginal productivity of capital, in the crops of barley, wheat, sweet-potato and orange became zero. Therefore the marginal efficiency of those resulted in negative, and thus it would be natural that investment towards those kinds of harvest would face many difficulties.

(4) In rice and tea-crops, the marginal efficiency of capital exceeded the rate of interest of saving and also that of rice crop alone went over the rate of interest of debt. Accordingly, if investment for these crops would not be carried out sufficiently, disregarding the surrounding conditions, these phenomena mean capital-rationing in rice and tea-crops in the aspect of private capital and as far as borrowed capital is concerned, this condition covers tea-crop only.

IV. Agricultural Engineering

Abstracts Nos. 56—70

56. On geology, ground water and its disposal in the neighbourhood of Marugame Plains and Kaikon Salt-Field. Masuji AKIBA and others (Bull. Soc. Salt Sci., Japan **8** [5], 1955)

The authors carried out a survey relating to the conditions of configuration, geology and ground water in Marugame plains and the neighbouring area of salt-field, and investigated how to dispose the ground water of salt-field.

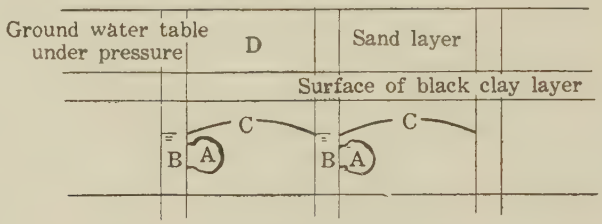
In order to get rid of the damage due to too-much ground water in Kaikon salt-

field in the city of Marugame, the ground water under pressure should be investigated. The influences due to tides from both sides of a short and a long period of time; and the changes in the rainy and non-rainy season, and the thickness and distribution of black, clay layer under the salt-field have to be studied.

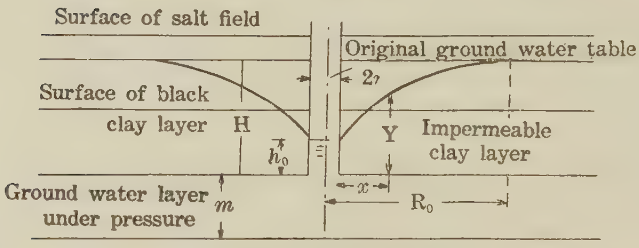
If the above-mentioned items are clarified, the problem may practically be solved by means of underground drainage by which the ground water table under pressure will be lowered. The method and result of the operation will be shown by the following diagram:

If the original ground water table D is lowered as low as the table C by the use of drain tiles and artesian wells, the influence will be reduced to almost nothing.

The movement of water raised up into the sand layer due to the capillary action of the black clay layer is considered in this case too, but perhaps this is not a large quantity, and if a considerable drop of ground water table C is practise,d the influence will become zero. In this case appropriate selection of sites and amount of yields concerning wells will be quite necessary in order to lower the ground water table from the original table D to the lower table C.



A: Drain tile B: Artesian well C: Ground water table lowered by the practise of drain tile
D: Original ground water table



Let Q_0 be the quantity of water which shall be discharged by drain tiles; then

$$Q_0 = \int k \frac{dY}{dx} 2\pi x m$$

where m=thickness of ground water layer under pressure
k=permeability constant

In case where $Q=nq$ and is yielded by each of n vertical wells, the approximate value will be obtained by the following formula:

$$H-h_0=\frac{Q}{2n\pi kn}\left(\log_e\frac{R_1}{r_1}+\log_e\frac{R_2}{r_2}+\cdots\cdots+\log_e\frac{R_n}{r_n}\right)$$

In the above formula all the lowered ground water tables were assumed nearly equal.

Although the general idea is determined as mentioned above, the surveys concerning such items as the condition of mutual influences between vertical wells, depth of the layer where the ground water under pressure is flowing, permeability constant, etc. should be practised in the field.

This is the so-called Elkington System which can prevent the ground surface from oversaturating, but a considerable difficulty will be met, as the drainage ditches are to be constructed through the black clay layer.

In such case the black clay soil of a certain width should be removed along the outside of the saltfield, and breaking of the ground water pressure in the inland area is considered as one of the measures. In order to obtain a reasonable conclusion relating to the above, the authors want to carry out further investigation.

57. Study on acidic water in Agatsuma River system. Masuji AKIBA, Shozo NOGUCHI and others ("Jomo-Kochi" No. 13, 28-30, 1955)

In this survey, practised on 14-16 July 1954, the authors actually surveyed the changing status of pH value in the main course of the Agatsuma River and its distributories, extending a length of about 70 km further up from the confluence (City of Shibukawa) of the Tone River and the Agatsuma River.

The survey results were as follows:

(1) In the Agatsuma River system, the river water over pH 6 was distributed in the upper course of the Agatsuma River and partial distribution of the pH was only seen upstream the points where the Chisawa-gawa River and the Sukawa River are flowing into the river.

(2) pH value was lowest in the following river sections: the mid-stream of the Agatsuma River; the course from the confluence of the Sukawa River to that of the Yamada River with the Agatsuma River; and the southern part of the point where the Yukawa River is flowing into the Sukawa, the pH value being 2.0-4.0.

(3) Some of the rivers which are flowing into the Agatsuma River from the south show pH 6.7-6.8, but the other seven rivers generally give such weak alkaline reaction as pH 7.1-7.4.

(4) East of the junction of the Nakutagawa River some acid water sources must exist beside the rivers observed as above.

As mentioned above, the discharge of the Sukawa River which is strong in acidity occupies the greater part of the river discharges, and as the paddies which are being irrigated by the Agatsuma River system are scattered here and there in small areas, it is quite difficult to practise pollution prevention methods, and thus there is no better method than to avoid the use of the river water for agricultural use.

58. Air and vapor movement in soil due to wind gustiness. Hitoshi FUKUDA (Soil Science **79** [4], 249-256, 1955)

59. On judgement concerning fertility of salt-field. Shozo NOGUCHI and others. (Bull. of Salt Sci., Japan **8** [5], 1955)

As the bed soil of "Irihama" salt-field is composed of fine soil, many problems of much interest relating to water movement are waiting for our investigation. The problem which the authors has taken up as the subject for their investigation is the water movement descending toward the bed of salt-field from the ground surface, and they have specially practised an experiment about the suspending state of descending water in the sand layer.

The authors, in their experiment, used such materials as three kinds of sand and seven kinds of percolating waters in which distilled water and seven kinds of brines are included, and studied capillary height and distribution of water content in every part of suspending water columns.

It was clarified that the results of the above experiment were quite different from those of the calculation assuming that all the pores in the sand layer were filled with water, and the percentage occupied by the water content in the pores was approximately 70% at the maximum and 30% at the minimum. In other words, the diameter of the capillary tubes is large in the upper layer and on the contrary, small in the lower layer. The above phenomenon seems to indicate that it cannot be explained in the usual way, and the authors want to get a solution of the above by further investigation.

In case the water content besides suspending water continues to drop, the capillary water will begin to descend to join the ground water. As soon as the connection with the ground water is attained, capillary water begins to move in such a way as if it is a connected pipe. Accordingly, the capillary water coincides with the distribution of water content, when the capillary water is formed by the rising trend form the ground water.

The capillary water is very fine in diameter in the clay bed, and its movement becomes very slow owing to capillary resistance. In this case such dry state appears in the upper part that will often take place when the ground water table is low, and under such condition it is probable that a partial suspending state will occur in case of rainfall.

This is another problem of much interest, too, which requires further investigation for solution.

60. Trial manufacture of wire strain gauge and several measurement examples concerning plow and cultivator. Fusanobu SHOJI and Fumihiko SANO (Journ. Agr. Machin. Soc. Japan **16**, 122-126, 1955)

The authors manufactured a wire strain gauge for trial by themselves, and applied it to the stress measurement of principal parts of farm machinery by which the following points were clarified on the whole.

First, taking such simple members as shank and beam of a cultivator loaded statistically, they measured the stresses in them, and also obtained their values by a calculating formula. Thus, they investigated which of them was of more suitable value. According to it, the formula for curved beams was better than the general expression for beams. As an example of kinetic measurement, they measured the stress produced in the beam of a cultivator and the mold-board of a plough which were drawn by a garden tractor, and roughly investigated those effects the stresses gave upon them.

According to the investigation it was generally made clear that the total resistance against the tractive force of a cultivator passes through the frontal hitch, and group of principal stress lines are brought about almost in conformity with the sliding direction of furrow slices along the mold-board.

61. On distribution of threshed grains under concave sieve of power threshing machine. Fusanobu SHOJI and Fumihiko SANO (Journ. Agr. Machin. Soc. Japan **16**, 127-132, 1955)

When rice or wheat bundles are threshed by a thresher, the distribution of threshed grains differs very much by the method of bundle-handling, and the shape of distribution has to be observed with much concern as a problem relating to the distribution of the wind velocity produced by winnowing machine.

According to the experiment concerning quantitative distribution, when the operating condition in case of power threshing machine and the method of bundle-handling are equal, the threshed grains will show generally a definite form of distribution, which is to be decided by the inserting position of bundles of grain ears.

A I-type which was employed in the experiment showed W-figure distribution in case of one-man operation and V-figure distribution in case of two-men operation respectively; but there was no appreciable relation with the repeating method or overturing method.

If we divide this distribution process into the dispersions of low-degrees and that of high-degrees, the former is chiefly ruled by the number of revolution of threshing cylinder, and the form of distribution is shown by such a curve as the probability curve centering around the inserting place of bundles.

The latter, contrary to this, will be influenced very much by the number of revolution as well as the arrangement of cylinder teeth, and has such an action as to disperse the grains on both sides from the cylinder teeth. Accordingly, those collided with side walls were repulsed, and accumulated near by, and thus the peculiar type of distribution was shown.

At any rate the distribution form was of combined type of the above two kinds of distribution, so that it was a matter of course that the dispersion process of low and high degrees changed with the difference of the number of revolution, or the arrangement of cylinder teeth even in case of machine of the same kind, and thus it is considered that the characteristic property of the distribution type too will differ.

62. On several examples of annual employment of cultivators in Kanto District. Fusanobu SHOJI and Fumihiko SANO (Journ. Agr. Machin. Soc. Japan **16**, 64-68, 1954)
vators by farmers, which are coming into wide use recently in Kanto district, the
By the statistical consideration from the annual employment records of culti-
authors have got the following information in the concrete:

Annual service days of cultivators employed is about 10-20 days per year or about 1-3 hr. per days; in other words, the above time is needed to practise the required amount of farming operation. They are chiefly employed in the upland fields, but all of the eight farmers are more or less utilizing cultivators in the second crop farming of paddy fields, a fact which is characteristic and worthy of note for the use of cultivators in Japan. Cultivators are widely used for soil preparation in wide

sense, including such items as stalk-cutting, listing, soil-copering, etc., beside cultivating and weeding, which are original operations of cultivators.

Cultivators are chiefly aimed at cultivation of wheat, barley, and etc., but according to this survey, 21 kinds of crops are served by cultivators, or about 6 kinds of crops per farm household. Rather few attachments are employed, say, about 3 kinds are only used, excepting self made attachments. Farming operations are being practised by a single part in case of upland fields, and by combined parts in case of paddy fields. About 4-5 combined parts are largely used.

It is considered in short cultivators have entered the period of practical use, but they are not widely spread and used justifiably enough among farmers.

63. On Santomi section on Musashino plateau developed in the former age of Tokugawa Shogunate. Fusanobu SHOJI (Journ. Agr. Eng. Soc. Japan **22**, 54-62, 1954)

Santomi Section of Saitama Prefecture was reclaimed from a waste land at the hand of a feudalistic lord of Kawagoe, extending over 3 years from 1695. The original form of the settlement in those days has been retained even now, by the reason of which it has been designated as one of the historic places regarding land development enterprises.

This paper is a survey report about the actual status of the land reclamation program and its development up to now.

It is the special feature of this land development project that such a perfect linear-type settlement as is seen in the "Waldfufendorf" in Germany was adopted.

At the beginning of the development, roads 11 m wide were constructed lengthwise and crosswise through the waste land, and then residential sites were arranged like costae along either side of the roads.

A lot 72 m wide and 675 m long was allotted per farm house-hold, about 5 ha being the standard area. Thus 180 farmers were settled, but at present the area of a lot per farm-house-hold has reduced to about 2-1.5 ha on the average.

This reason comes of the population increase, creation of branch families, etc. This changing status is shown relatively by the increase of the density of dwelling houses along roads, and at the same time it is considered that the decrease of cultivated area of every farm house-hold was well balanced by the maturing of the reclaimed fields and intensification of agricultural management (development of rotation).

It is understood that great efforts were taken for drinking water, but at present one well is owned by 3-6 house-holds, 30% of which are pumped up by means of electric motors, and the water is distributed among them. Thus, the water amount used per house-hold a day has increased as much as 540-720 l. Such development of water use chiefly depends upon the reason why the shipment of vegetables has grown prosperous and their washing become inevitable for the farming in the suburbs of Tokyo.

The settlers chiefly used hoes at the time of their settlement, and draft cattle were only employed for transportation, but in recent years a remarkable progress toward mechanization has been made for transportation by trucks and autocycles, tea-manufacture, spraying of chemicals, threshing and processing, etc.

However, as for soil preparation machineries, they have not yet been introduced into farming so much as the above mentioned jobs, for rotation in small lots is being

practised as before, and moreover, the stress is chiefly laid on an intensive management.

The author heartily considers that the progress of agricultural mechanization in order to increase the productivity of land and labor should be expected very much in the future.

64. On the scale prevention by the method "Addition of Crystal Seed". Jiro SUGI and others (Bull. Soc. Salt Sci., Japan **8** [5], 1955)

The scale prevention is one of the most important problems in salt-production. Nowadays the "Bittern-Pouring Method" is widely used in Japan, but this method has many defects. Under these circumstances the authors devised a new scale prevention method which they named "Addition of crystal seeds" method. This may be applied not only to the vacuum evaporation system, but also to the auto-vapour-compression system.

They obtained remarkable results by using this new preventive methods; namely, by concentrating brine (at about Bé 19) continuously for 72 hours, it became obvious that the scale adhered to the heating pipe was practically nothing; moreover, the cost of applying the new method was negligible. This report includes the results of two experiments: The experiment 1 was of a small scale, and the experiment 2 of large scale.

From these experiments the following conclusions were obtained:

(1) As for the seed crystals, nothing is more effective than calcium sulphate and its hydrate.

(2) As for the crystallization water of calcium sulphate hydrate, the hydrate which was crystallized in the evaporating condition is most effective.

(3) Even in case the crystallization water of seed crystals are the same, the effect for scale prevention differs considerably due to the difference of the characters.

(4) By applying this new method to the present evaporation method, we can expect to lower the cost of salt manufacture and to increase the production.

The authors have devised new evaporation method: one is vacuum system and the other is auto-vapour compression type, both of which are free from scale.

65. Fundamental calculation concerning sloping salt-field. Jiro SUGI and others (Bull. Soc. of Salt Sci., Japan **9** [1], 1955)

In this report the authors evaluated the flow-length (bed-length), considering evaporating loss from the ground surface and concentration ratio. Then it was measured how the discharge changed in response to the variation of evaporation loss at each bed-length.

Authors studied the two kinds of salt-field, one having a vinyle sheet which has no percolation loss, and the other having clay-bed with little percolation. At first the authors calculated the bed length, and in this case the evaporation loss from the ground surface and concentration. And the authors practised the calculation of the discharge variation too, when evaporation took place concerning the bed length.

(I) Calculation of concentration ratio on clay-bed.

(a) Theory of concentration.

Assume that the flowing water will evaporate or percolate from the ground at

a constant velocity, then

$$\frac{C_2}{C_1}=\left(\frac{W_1}{W_2}\right)^{\frac{E}{E+P}} \qquad \cdots\cdots(1)$$

where

C_1 W_1: concentration & quantity of brine at time $T=0$

C_2 W_2: ,, ,, $T=T_2$

E: velocity of evaporation $l/m^2/\text{hr}$

P: velocity of percolation $l/m^2/\text{hr}$

(b) Calculation of bed length.

For the determination of the most suitable length of flow, such items as concentration ratio, evaporation from the ground, percolation loss, discharge, amount and thickness of sprayed sand etc. should be taken into consideration.
then

$$L=W_1'\sqrt{\frac{A}{E+P}\left\{1-\frac{1}{\left(\frac{C_1}{C_2}\right)^{\frac{E+P}{E}}}\right\}} \qquad \cdots\cdots(2)$$

where

L: bed length

W_1': discharge

A: constant in the expression $V=AW_1'$

(c) Calculation of discharge.

In case the length for water flow is constant, the discharge will be as follows:

$$L=W_1'\sqrt{\frac{A}{E+P}\left\{1+\frac{1}{\left(\frac{C_1}{C_2}\right)^{\frac{E+P}{E}}}\right\}} \qquad \cdots\cdots(3)$$

(II) Calculation of concentration in case of impermeable bed

Concentration in case of impermeable bed is obtained by inserting the percolation velocity $P=0$ into formula (1)

The above mentioned study is subject to restrictions due to various assumptions, and of course it can't be said a perfect one. The authors, therefore, wish to improve it more and more in future.

66. On the effect of scale prevention by contact stabilization method. Jiro SUGI and others (Scientific Papers of Central Research Institute of Japan Monopoly Corporation No. 92, 83-7, 1955)

The authors made researches on the contact stabilization method. Using marble, lime stone, dolomite, sand, scale, $CaSO_4 \cdot 2H_2O$, etc. as the material of contact units, they practised concentration of bring from 10° Be' to 20° Be' at the liquid temperature as high as 97°-98°C. In the course of the operation the authors measured the concentration of Ca in the brine, and lastly made quantitative analysis concerning the amount of scale adhered. As a result, the amount of the adhered scale reduced to about half as much as the amount in case a contact unit wasn't used. Such being the case, if evaporation of brine is practised to such an extent that the same amount of scale as that in no contact unit is produced, the time resuired for the evaporation may become about twice as long as in the other case. However, the loss of pressure

due to passing through the contact unit is considerably large, so that it becomes so much disadvantageous to Japan where the power expenses for the circulating system are great, and moreover, as the scale adhering velocity is very fast in the case of evaporation of highly concentrated brine, it is quite questionable whether or not the operation is of practical use, even if the time required for evaporation becomes twice as compared with the original method.

67. Experiments on aggregates in paddy and upland fields. Fujio YAMAZAKI and Toshirō YAMADA (Journ. Agr. Eng. Soc. Japan **23**, 30-34, 1955)

The authors made some experiments on the structure of soil in paddy and upland fields by aggregate analysis by means of wet sieving, and the chief result obtained is described below. However, the number of experiments were too scarce for the authors to say that they obtained a satisfactory conclusion on a universality level, but it will surely become a key to the future researches of this kind.

(1) In clayey paddy fields a decreasing tendency of the percentage of soil aggregates was shown by *shirogaki* operation which means the soil preparation by plowing before transplantation of rice-plants are practised.

(2) Higher degree of aggregation was show in the paddy fields where the transplantation of rice-plants are being continued for a long time without practising *shirogaki* and plowing as compared with those where the above two operations are made before the rice-transplantation.

(3) Comparison between the paddy fields where rice-plants were grown by seedling in furrows among wheats for 3 years and those where rice-transplantation was practised after *shirogaki* operation, showed that the former was a little higher in percentage of aggregation than the latter at the depth of 0∼11 cm from the ground surface, but it was contrary at the depth of 12∼17 cm which corresponds to the floor of a plough.

(4) The degree of aggregation was higher in the paddy fields where drainage is being practised by under-drains than in semi-wet paddy fields.

(5) By the practice of reclamation aggregates will decrease in the soil of wood lands where the degree of aggregation is high owing to the decay of fallen leaves, fallen twigs, etc., but as soon as the farming is stabilized and compost sufficiently applied to them, the degree of aggregation will begin to be restored again.

(6) Infiltration capacity will also decrease in proportion to the lowering of the degree of aggregation due to reclamation operation.

68. Study on stump pulling (Seventh report). Field experiment for burning stumps by boring a number of holes into them. Fujio YAMAZAKI, Toshio YAWATA and others. (Journ. Agr. Eng. Soc. Japan **23**, 62-67, 1955)

The authors made a report on the results of the preliminary indoor experiments in the Fourth report. In this report the authors are giving an information about the results of the field experiments which were practised in a settlement at the foot of Mt. Iwate, and in the compound of the Tokyo University of Agriculture and Technology on the basis of the results of which they investigated the practical use of the stump burning method by boring holes in stumps.

According to the experiments practised at the above two places, this method should be practised in the field by the following suggestions:

(a) Electric energy is generated by a midget power generating apparatus and holes 24-30 mm in diam. are drilled by 3/4 HP electric drills; (b) as for the type of drilled holes, those of regular L-type in case a stump is low, and those of oblique-type in case a stump is high, are drilled respectively; and the intersection of a horizontal and an upward hole are made in the depth of about 15-20 cm from the ground surface; (c) the burning operation should be practised at about the end of the dry season, and in this case the earth around stumps in question be dug and removed at least one month before the above operation in order to bore holes into them, and dry up stump as well as the innersides of holes; (d) use small pieces of dried wood as igniting material, on which with paraffine and pine resin melted together are coated. Put them deep into the holes and heat them by a torch lamp; (e) when ignited, give a blast to the fire by a hand air-blower for a while to ensure the ignition and help the combustion by using a chimney over the upward hold.

In conclusion the authors described that the condition in case of practical use of the stump burning method were pretty limited, so they investigated them in details, dividing them into two phases, technological condition and social and economical condition, in order to clarify the limit of application.

69. Factors which influence hourly change of soil permeability during saturated water flow in soils (First report). Effect of air bubbles in pores. Toshio YAWATA (Journ. Agr. Eng. Soc. Japan **22**, 509-518, 1955)

If water is continuously poured to the soil, the permeability constant will gradually change. Various items are mentioned as its reasons. As amount of air-bubbles existing in the soil is counted as one of them, the author has taken up the item as a subject of his investigation.

The author used porous stone as material for his experiment, in place of actual soil, less the change in consistence other than air bubbles in pores should be brought about. By the use of this material, we shall easily obtain the volume of air bubbles, which is obstructing the flow of water, occupying a part of the pores, by means of such a simple method as weighing in the water.

The author practised a continuous irrigation by ground water fresh from a well which contained a considerable amount of free gas. The irrigation was continued for 50-100 hours under a constant head upon the material about 0.2 mm in grain size, and the above experiments were repeated about 10 times, and the results of which were as follows:

(1) Even if such change as relaxation or subsidence doesn't take place in the inner part of soil, the permeability constant of soil gradually decreases in the course of many hours owing to the influence of air bubbles only, thus reaching a constant value after about 100 hours.

If you measure the amount of air bubbles in the pores when the permeability constant is in a lowered state, you will find that the amount of air bubbles doesn't always increase as compared with that in case the constant is high, and it often decreass notwithstanding the air bubbles decrease.

The author gave the following interpretation to the above phenomenon by in-

troducing the idea of actual bubbles as for the change of air bubbles in the pores of soil.

The author concluded that the change of the collective state of air bubbles which will take place in the course of time and the adhering state to the surface of soil particles should be taken into consideration besides the variation of the air bubbles.

70. Survey report of Kyushu disasters in June 1953 (Report of farm land team). Toshio YAWATA and others (Journ. Agr. Eng. Soc. Japan **22**, 280-289, 1954)

The authors were engaged in surveying the flood damages in Kyushu District due to the heavy rainfall in June 1953. As for the status of the erosion of farm soil and distribution of silted deposition, the authors practised surveys at Daifuku-mura, Fukuoka Prefecture, in the Chikugo River system and at Jinnai-mura, Kumamoto Prefecture, in the Shirakawa River system. As regards the deposition in the damaged areas, the physical properties of the deposit as they deposited were investigated as well as the distribution of the silted deposition classified by grain size and its thickness in the usual way. Beside the above such items as the status of packing and permeability constant in every layer of the stratified deposit and infiltration capacity of the whole deposit were actually surveyed at several places. As a result of the above investigation the following facts were made clear:

(1) In case of *Yona* as well as *Ado* the distribution of bulk density of the uniform thick deposits shows that the deeper the deposit, the more the density decreases, and the more porous the packing becomes.

(2) In case *Ado* layer is contained in a very fine sand layer, the layer prevents water from percolating, and infiltration capacity of the whole layer nears the original permeability constant very much.

V. Fisheries

Abstracts Nos. 71 — 95

71. Study on the amount of internal organs in fish, with some reference to its meaning on their habit. Ikusaku AMEMIYA, Takashi HIBIYA, Tamotsu TAMURA, Yoshio KÔ and Teizô SHIODA (Review of Fisheries Science in Japan [Suisangaku no Gaikan], published by The Japanese Society for the Advancement of Science 200-223, 1954)

Biometrical study on the amount of internal organs in fish, were carried out (one species of chimaeroid and 67 species of teleosts). So far, the authors had clarified, that the relative growth of these organs could be indicated generally by the following formula:—

$$y=ax^k$$

where y is the weight ratio of each organ to body, and x is the body weight in grams.

Comparing the value of the ratio of weight of heart/body weight, there is seen a remarkable tendency, that, the more active species the fish is, the bigger the heart

is. Cardiac muscles also develop better in the active fish than in the inactive one. Among the taxonomically related fish, the value of the ratio of weight of liver/body weight resemble with one another, but the correlation between the value of the ratio and the behaviour or feeding habit of the fish is not obvious. Though the individual difference is quite apparent, the value of the ratio of the weight of spleen/body weight is high in the active fish, and is low in the inactive one. As to the value of the ratio of the amount of whole viscera/body weight, there is seen the same tendency as mentioned above about the spleen.

Sexual difference can not be found in the weight of heart and of spleen, but the liver of the female become heavier than that of the male in the breeding season. At the same time, in the liver, the fat decrease, and the protein and moisture increase, especially in the female.

72. Seasonal difference in the amount of inorganic phosphorus in blood serum of fishes. Ryushi ICHIKAWA (Rec. Oceanogr. Works in Japan **2**, 113-116, 1955)

Annual rings and spawning marks appearing on scale, fin ray, otolith, vertebra and other hard tissues of fish have been well studied by many biologists, as to be the special marks expressing the temporary retardation of their calcification process. And this retardation is supposed to be caused by the seasonal change of external and internal factors, i.e. the environmental or hydrological conditions and the physiological conditions of fish body itself, either directly or indirectly. Apparently, the lowering of water temperature would cause the inactivity of metabolism, and the maturing of gonad, malnutrition or disease would cause the retardation of calcification in these tissues. Here, to clarify the mechanism of the annual ring formation, the author investigated the seasonal change in calcium metabolism of fishes, by measuring the amount of inorganic phosphorus in blood serum of fishes.

The experiments were carried out in July and August 1953 and January and February 1954, using the carp, *Cyprinus carpio,* and the eel, *Anguilla japonica,* as materials. Body weight of carp in summer was from ca. 120 gr. to 160 gr. and that in winter ca. 700 gr. to 900 gr. That of eels in both season was from ca. 700 gr. to 900 gr. That of eels in both season was from ca. 150 gr. to 200 gr. The method of the quantitative analysis of the inorganic phosphorus in blood serum was follows: the ventral aorta was cut off at the point of about 2 or 3 cm from the heart and the blood pouring out from it was received in a glass tube. The blood obtained was centrifuged and the serum was separated from it. The colorimetric analysis of the amount of inorganic phophorus was carried out by the modified method of FISKE-SUBBAROW.

In case of eel, the amount of inorganic phosphorus in blood serum was from 8.2 to 13.5 mgr. per deci-litre and the mean value was 11.1 during summer (9 individuals). On the contrary, during winter (8 individuals) this value was from 3.5 to 9.2 and 6.6 the mean value. In case of carp, this valeu was 8.8 to 19.5 and the mean was 13.4 during summer (12 individuals). On the contrary during winter (11 individuals) this was from 3.3 to 9.8 and the mean was 6.8. From these results, it is sure, during winter both species have much fewer amounts of inorganic phosphorus in their blood serum than that in summer. FONTAINE in 1932 investigated the relationship between the true bone formation and the amount of inorganic

phosphorus in blood serum of fish. Each mean value of Selachie (7.8 mg/dl) and Cyclostome (5.6 mg/dl) was both less than half of Teleostei (15.8 mg/dl) though his report didn't state the season when the investigation was carried out.

This tells that during winter the phosphate ion concentration in blood serum of Teleostei decreases to a low value nearly equal to that of Selachie. Thus the decrease to this amount is supposed to be one of the causes of the retardation of calcification in hard tissues of fishes in winter just like the rachitic condition in case of mammals which is often followed by a low value of the inorganic phosphorus in blood serum. Therefore, as it had been supposed to be so, the author thinks he can conclude by his experiments that there were definite relationships between the seasonal change in the amount of the inorganic phosphorus in blood serum of fishes and that of the calcification process of their hard tissues, which makes the annual ring on them.

73. Ecology of young fishes in the eelgrass bed, and its bearing to fish conservation program. Yasuo OHSHIMA (Review of Fisheries Science in Japan [Suisangaku no Gaikan] published by Japanese Society for the Advancement of Science, 128-181, 1954)

Eelgrass beds are very common in the shallow coastal areas of estuarine bays and other sheltered waters. Though these beds can be utilized as the fishing grounds of certain animals or as the culture bed of the blood clam, their most important merit consists, from the standpoint of fishery, in providing the unique nursery for the young of various fishes and thus supplying commercial fish stocks with recruitment.

In this paper the author reports the results of his field survey on the ecology of young fishes in the eelgrass beds of Fukue Bay, Aichi Pref. and its adjacent waters, and reviews critically the existing regulations pertaining to the conservation of eelgrass beds and the young fishes therein, in the light of the above results.

The method and results of the field survey are summarized as follows:

(1) Quantitative samples of young fishes were collected by seining fortnightly or monthly during 1939-42. Supplemental collections were made on other occasions.

(2) In these samples are represented a total of 161 species of fish, of which more than 30 are commercially important. Most of the species occur in the eelgrass beds during their young stages only, while other species dwell there all their life. The young of some species do not occur in these samples in spite of the fact that their adult stages are very common in the neighbouring waters.

(3) The young fish fauna of these eelgrass beds undergoe considerable seasonal change. It is richest in amount and variety during August through October, and poorest in January and February.

(4) The eelgrass beds of the studied waters are distnguishable into four types with regard to the species of Zostera, water depth, and other topographic factors, as shown in the table. While the young of some species occur in all types of beds, the occurrence of other species is related to the type of the bed. Consequently, specific composition of the young fish fauna varies according to the type of the bed.

(5) In such species which occur in eelgrass beds at their young stages only, the young become settled in the eelgrass bed at a certain size, and leave the bed

after attaining another size. These sizes, which vary with species, can be estimated by preparing such a diagram for individual species in which the population density and the size range of the young fish present in a eelgrass bed are plotted against the calendar month.

(6) Young fish fauna is far richer in amount and variety in eelgrass beds than in the neighbouring naked sand- or mud-bottomed waters.

(7) In eelgrass beds, young fishes usually depend for their food on such small animals as copepods, amphipods, shrimps, crustacean and annelid larvae, small gastopods etc. which are very abundant in these beds. However, as they grow nearly to that size at which they leave the eelgrass bed, they begin to seek for other food.

(8) Detailed records on the catch of the young of commercially important fishes are shown in the annexed table.

Type of bed	Topographic conditions	Species of *Zostera*
1	Lower low water level or above; inside the bay	*Z. nana*
2	Lower low water level; inside the bay	*Z. marina*
3	Lower low water level; outside the bay	*Z. marina*
4	Water depth 3–5 fathoms; outside the bay	*Z. marina*

74. An ecological study on the marine fire-fly, *Cypridina hilgendorfii* G. B. Müller. Hakaroku Nakamura (Review of Fisheries Science in Japan [Suisangaku no Gaikan], published by the Japanese Society for the Advancement of Science 108-126, 1954)

The marine fire-fly, *Cypridina hilgendorfii* G. B. Müller, is one of the commonest luminous marine animals in Japan. The animal dwells in sand-muddy bottom of shallow bays and swim briskly at night in the lower layer of the water to seek food which consists of the dead bodies of various animals. In the vicinity of Shinmaiko, Aichi Pref., the animal can be caught with a trap from April through November. The trap consists of an earth-ware bowl covered with gauze having a small hole in its centre. Meat or viscera of fish is placed in the trap as bait.

The life history and some biological features of this animal was studied in 1943-44 and the following results were obtained:

(1) The spawning season continues from the first decade of May to the second decade of October, with peaks in late May and August.

(2) The animal is dioecious. The males are characterized by smaller body size, the dorsal part of the thorax with less folds and the presence of a penis.

(3) Eggs are extruded from the ovary when they grow to the size of ca. 0.34×0.29 mm and incubated in this dorso-posterior part of the shell for 11-14 days until hatching. The number of the eggs incubated by a single female at one time ranges from 20 to 70. Probably an individual female incubates eggs twice or three times in life, with an interval of about 10 days between incubations.

(4) The author could not observe copulation behaviour.

(5) The eggs hatch into the young, which swim out of the mother's shell at the size of ca. 0.8 mm in length. From the results of rearing experiments of each stage and the materials obtained by field collections, it is conjectured that these young graw to the adult form after five ecdyses in about 45-49 days.

(6) The life span of this species was estimated at 3 to 4 months in females born during warmer season, but as long as 9-11 months in those born in autumn and surviving over the winter. No conclusion was reached on the life span of the male.

(7) Several generations succeed in one year as schematically shown in the figure. All individuals of the 3rd and part of the 2nd generation survive over the winter to give birth to the first generation of the next year.

(8) The lowest temperature and chlorinity at whilh the animal can live indefinitely in an active state are about 8°C and Cl 10 respectively.

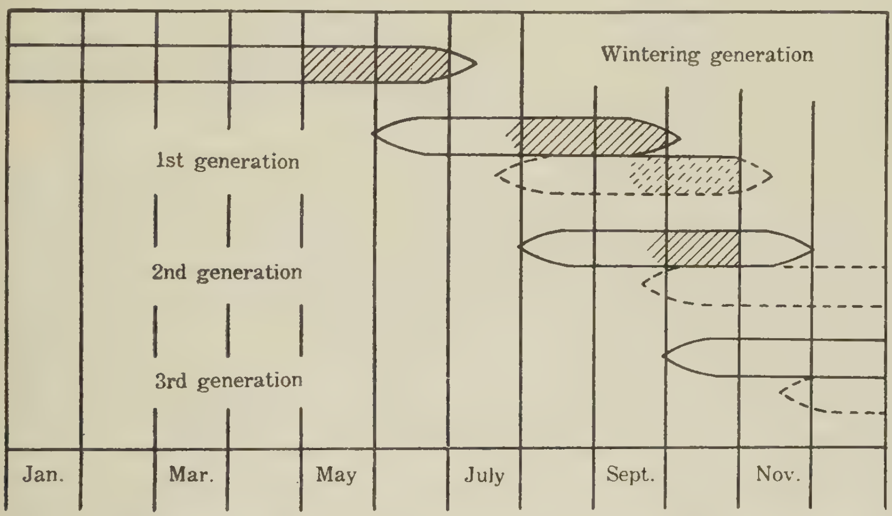


Fig. 1. Succession of generations in *Cypridina hilgendolfii*. Spawning period is indicated by hatching. The late-born group of each generation is shown brokenlines.

75. A study on the phenomenon of the Tobi-Koi or Shoot carp. I. On the earliest stage at which the Shoot carp appears. Nakaroku NAKAMURA and Shôgorô KASAHARA (Bull. Jap. Soc. Sci. Fish. **21**, 73-76, 1955)

Some individuals among carps of one batch grow much faster than others in the same condition. We call them "Tobi-Koi" or Shoot-carps. They show characteristic asymmetry on the frequency curve of the body length of the batch. We calculated the skewness

$$Sk=\frac{1}{\sigma^3}\cdot\frac{1}{N}\cdot\sum f_i(x_i-\bar{x})^3$$

and found that its value is larger than ± 1.5 in many cases in which the Tobi-Koi appears. The frequency curves of the egg diameter, body length of hatched larvae and 8 days old post-larvae kept without feeding, show approximately the normal dis-

tribution, but after 20 days of culture, fed with Cladocerans, the Tobi-Koi individuals are seen to appear.

76. Comparison of the carp and the crucian carp from the pisci-cultural point of view. Nakaroku NAKAMURA (Bull. Jap. Soc. Sci. Fish. **21**, 77-81, 1955)

With regard to ecological characteristics of the carp and the crucian carp when used as materials of loosely diffused culture, the present study was carried out to compare them with each other. The result obtained were as follows:—

(1) Survival rate of the crucian carp is always higher than that of the carp, yearlings of the crucian carp grow faster than the other in such circumstances as without sufficient food for them.

(2) While there occurs unevenness of growth among the batch of carps, the crucian carps grow always rather evenly.

(3) The difference of the feeding habit of the two species is considered as one of the main causes of the above mentioned phenomenon. The carp feeds mainly on comparatively large bottom fauna (*Chironomus larva* et.), but the other depends on the so-called "Aufwuchs" (minute adherent organisms), algae and organic detritus, namely matters as available to the crucian carp are more ubiquitously present than those for the carp.

77. Studies on the protoplasm of algae (I). Koji NOZAWA and Yuriko NOZAWA (Bull. Jap. Soc. Sci. Fish. **20**, 878,-880, 1955)

The permeability of the cell of the laver (*Porphyra tenera*) to some nitrogenous compounds such as potassium nitrate, ammonium sulfate, ammonium nitrate and urea was investigated by the method of plasmolysis critical concentration.

The permeable coefficients estimated by the TRÖNDL's formula were 0.50 in the potassium nitrate, 0.62 in the ammonium nitrate, 0.64 in the ammonium sulfate and 0.58 in the urea.

It was found that the permeability to the urea was not so great, but the penetration of this was ascertained by the cytochemical detection as minute granules within the cytoplasm.

After some mechanically injurious operations to the cells, such as mere pricks with a needle, if a piece of the injured *Porphyra*-frond was transferred from the higher osmotic medium to the lower one, some injured cells take the amoepoid shape, and the pseudo-podia like swellings attack the adjoining cells one after another, making a "plasmidium-like" radial figure. These figures were recognized with the naked eye as green spots of the same feature as the "perforating disease" which was previously reported by SUTO and UMEBAYASHI as a parasitic disease of the laver.

78. Studies on the ecology of the Concocelis-phase of *Porphyra tenera* KJELLM. I. Hirosi YAMASAKI (Bull. Jap. Sci. Fish. **20**, 442-446, 1954)

The development of Conchocelis-phase of *P. tenera* was traced from early stage of penetration of the carpospora into the shell to the adult state, and the formation of monosporangium was also investigated, especially, from ecological viewpoints.

After settling on the surface of a shell, whole contents of the spore penetrate into the shell in a few days, leaving the cell membrane on the surface and a small hole through which the plasma have passed into. The plasma become one or two spherical chambers within the shell, and then short filaments are pushed out from

the chamber, which develop into slender and long filaments.

As the filaments grow longer, branching oppositely, they become the protonema-like bodies which are visible by the naked eyes as dark-purple spots.

Monosporangia are formed as lateral branches of the filaments. For only a short time of early stage they are simple and slightly branched inflations, but many branches are formed later. Some branches erert up towards the surface of shell and finally make openings to the surface though which monospores are liberated out. In the culture, many sporangia were found in the beginning or middle of August and the liberation of the spores began in the middle of September.

After liberating the monospore, they all remained alive, forming sporangia again in the next spring.

79. Studies on the ecology of the Conchocelis-phase of *Porphora tenera* KJELLM. II. Shedding and fixing of spores. Hirosi YAMASAKI (Bull. Jap. Sci. Fish. **20**, 447-450, 1954)

The shedding and the fixing of spores liberated from sporangia on the Conchocelis were investigated and the following results were obtained.

(1) The shedding begins after sunrise and continues for two hours on fine day, but on cloudy days the shedding is observed till nearly eleven o'clock. In the former case shedding was not observed at night.

(2) Spores fix themselves within two minutes after touching the substratum. The fixing of most spores occur immediately after shedding and decreases to about a half after an hour. The fixing ability of spores is unchanged in darkness.

(3) The spores liberated are from 8.7 to 13.7 μ (mean diameter is 10.7 μ) in diameter.

80. Biochemical studies on *Porphyra tenera* KJELLM. I. On the change of the catalase activity. Hirosi YAMASAKI (Bull. Jap. Sci. Fish. **20**, 1006-1009, 1955)

The change in the catalase activity of *Porphyra tenera* and a few coral algae were studied by the iodometric titration.

(1) The catalase activity for the extraction of the frond varies during the course of the day: i.e., the activity shows lowest at 12-16 o'clock.

(2) The activity was reduced when theh fronds were exposed to sunlight. It was reduced by about 75% when exposed for two hours, and by 60% when proposed for four hours in *Porphyra tenera*. But in the coral algae, it was reduced by 30% when exposed for 30 minutes. In both cases, the activity was not markedly reduced under certain limit by longer exposures.

(3) In *Porphyra tenera* the activity was reduced when phenol and urea were added.

81. On the culture of the marine plankton diatom, *Skeletonema costatum* (GREV.) CLEVE. Yoshiyuki MATSUE (Review of Fisheries Science in Japan [Suisangaku no Gaikan], published by The Japanese Society for the Advancement of Science 1–41, 1954)

The separation and the persistent culture of many marine plankton diatoms was made by the author to find out any suitable species which can be used as food for the rearing of some marine animal larvae. By this research the author was able to select a centric diatom, *Skeletonema constatum*, as one of the most excellent species

for the purpose.

The diatom is very suitable for maintaining the culture under laboratory conditions; it grows actively under wide temperature range, covering 0-33°C and reaches to a very dense population. *Skeletonema costatum,* however, seemed to be too large as food for small marine larvae, being that it has a short cylindrical shape and is generally 10-15 μ in diameter.

But, it was found that the diatom diminishes its size rapidly during the successions of subculture. From the author's experiments, it was observed that cells having ca. 10 μ in diameter reduced to minute sizes of ca. 4 μ in diameter after a culture period of several months. Auxospore formation was observed sometimes but it didn't develop in usual culture solutions, and thus the recovery in size was prevented. The diminution, however, seems to have a limit as the diminution didn't progress less than ca. 4 μ in diameter in spite of long time maintenance of the culture.

Skeletonema costatum, diminished in size, was proved to be a very favorite food for some marine larvae, especially for larvae of the crustacean species. The complete rearing on such species as *Penaeus, Eriocher* and *Balanus* was succeeded by using the cultured *Skeletonema costatum* as their larval food.

The general culture conditions of the diatom in the laboratory are described in the paper.

82. On the sulphide deposition in the shell of baby-clam under some environmental conditions. Yoshiyuki MATSUE and Kazuo SANO (Aquiculture 2, 12-19, 1955)

It is well known that the outer shell surface of any bivalves which are living in sandy or muddy bottoms of a strong reducing condition, is generally contaminated with a deep dark color. The contamination is considered to be the result of a mere clinging of a black substance, probably iron-sulphide, produced in the bottom, but any particular investigations have not yet been done. The authors made some observations on this phenomenon by use of the baby-clam and the following results were obtained:

(1) Though the shell contamination discolors by oxidation in a short time after the clam is taken out in the air, it may be reproduced again by immersing the shell into H_2S water. This simple treatment may be available to discern the conditions of the bottom in which the clam was living, whether it was of a reducing character or not.

(2) The shell contamination occurs in some portions by the clinging of the black substance upon its surface, but considerable portions are known to be deposited in the shell. A remarkable deposition was observed microscopically in the cuticle and upper prismatic layer of the shell, but less in the lower prismatic layer and none in the nacreous layer.

(3) Determination of the iron contents in each layer of the shell showed differences in the value corresponding respectively to the result of the microscopical observations as above mentioned. The value ranged 10-160 γ/g. Though determination of other metals was not made, the black substance seems to be consisted mainly of iron-sulphide.

(4) Examination on many shell samples make us deduce that the iron-sulphide deposition in shell must be resulted mainly during the time when the shell is being

formed under the strong reducing conditions of the bottom, while the penetration of the sulphide secondarily in the formed shell seems to be far less.

83. Notes on the action of radioactive substances on aquatic animals. Yasuo SUYEHIRO, Takashi HIBIYA, Shizuo YOSHINO, Teiji YAGI, Yoshikazu TSUKAMOTO, Motohiko AKAMATSU, Kôzô TAKAHASHI and Takemitsu IMAMURA (Science [Japan] **24**, 619-622, 1954)

This report deals with the physiological action of radioactive substances, viz. the chemical Sr^{90} and the ashes taken from the deck of the fishing boat "Fukuryu-maru No. 5", on aquatic animals. The results are given under sub-titles as follows:—

(1) Transmission and metabolism of Strontium 90 in aquatic animals.
(2) Effects of radioactive materials upon blood pictures of fish.
(3) Effects of radioactive materials upon the development of aquatic animals.
  (i) Water fleas.
  (ii) Fishes.

84. Studies on the effect of copper upon marine bacteria. I. The depressing activities of copper sulfate upon the development of bacteria in sea water. Nobuo TAGA (Bull. Jap. Soc. Sci. Fish. **20**, 280-285, 1954)

In 1943, WAKSMAN described the effect of copper upon the development of bacteria in sea water, and he isolated the specific "copper bacteria" that had a definite affinity for copper from sea water and surface film. The present author studied on the bacteriostatic or bacteriocidal effect of the various concentrations of copper sulfate upon the development of marine bacterial community in sea water. The results of the investigation are summerized as follows:

(1) When the copper sulfate dissolved into the crude sea water, the development of marine bacteria was completely depressed in concentrations of 500 ppm. within three days. The addition of lesser amounts of copper sulfate than 200 ppm., however, retarded the bacterial development for only one or two days, and then this depressing effect was overcome after three days and the rapid development of bacteria resulted.

(2) On the other hand, the addition of copper sulfate to the REUSZER's medium had the bacteriostatic or bacteriocidal effect upon most of the marine bacterial strains in concentrations of 300 ppm.. The specific "copper bacteria" isolated from sea water of Aburatsubo Bay, however, developed well in 400 ppm.. It might be suggested that the "copper bacteria" tolerate fairly well against copper, and as to the other strains, the Gram-negative strains seem to be slightly stronger than the Gram-positive ones, and among those the agar-digesting strains are slightly weaker than the other Gram-negative ones.

(3) The addition of copper sulfate to the sea water medium influenced the viability of marine bacterial strains; as to the most of them, they seemed to be weakened to one-third of the normal condition in concentrations of 200 ppm., while as to "copper bacteria" to two-thirds in 200 ppm., and to one-sixth even in 400 ppm.

85. Studies on the effect of copper upon marine bacteria. II. The occurrence and distribution of the specific "copper bacteria" in sea water. Nobuo TAGA (Bull.

Jap. Soc. Sci. Fish. **20**, 1076-1080, 1955)

In the previous paper, the author reported on the depressing effect of copper sulfate upon the development of marine bacterial community, and then he described the existence of a bacteria that tolerated fairly well against copper. The present report gives a preliminary survey on the occurrence and distribution of the specific "copper bacteria" that have a definite affinity for copper in the sea water. The results of the investigation are summarized as follows:

(1) The specific "copper bacteria" that develop as the red brown colonies on the WAKSMAN's copper medium, are detected always in the sea water and in the surface slime films on glass slides submerged in the sea at Aburatsubo Bay. General characteristics of the bacteria were observed to be the same as WAKSMAN's observations (1943).

(2) The amounts of "copper bacteria" vary with the fluctuation of the total bacterial population in sea water. Also the vertical distribution of the "copper bacteria" is not same in the depths or with seasons.

(3) When the glass slides are submergel in the sea for about two weeks, so many "copper bacteria" are frequently detected in the slime films attached on the glass slides.

(4) The relative amounts of "copper bacteria" in the sea are different from place to place: in general, they seem to distribute widely in the sea water of the oceanic region, while they scarcely distribute in the sea water of the coastal region where the land drainages or river streams affect strongly.

86. A simple determination of vitamin A in margarine I. Kōji NAITO and Takajirō MORI (Vitamins **8**, 17, 1955)

In the determination of vitamin A added in margarine, the spectrophotometric and colorimetric methods are not available, unless the interference of the officially permitted artificial pigments, yellow AB (phenylazo-β-naphthylamine) and OB (tolylazo-β-naphthylamine) are eradicated. To get rid of these pigments, the chromatographic procedure has been adopted. This procedure, however, requires skill and is not convenient for the routine work.

The authors have devised a simple method to remove the pigments by solvent extraction, which is far superior to chromatography.

The principle of the method lies in the finding that the pigments move quantitatively into glacial acetic acid layer containing a small amount of acetaldelyde from petroleum ether layer by shaking. In this treatment, vitamin A remains in petroleum ether layer. The petroleum ether solution of unsaponifiable matter of margarine, shaken with the above solvent, is pigment-free and ready to colorimetric estimation of vitamin A.

The recovery of vitamin A throughout the whole procedure was over 96%.

87. Animal protein factor (APF) and vitamin B_{12} in marine products. V. Variations in the vitamin B_{12} content of marine animals in spoilage. Part 2. Takajiro MORI, Yoshiro HASHIMOTO and Yasuhiko MAEDA (Bull. Jap. Soc. Sci. Fish. **20**, 604, 1954)

The aerobic and anaerobic bacteria were isolated from fresh or spoiled fish in

an usual manner and incubated with and without vitamin B_{12} for the tests of the activity to decompose or produce it. After incubation, culture media and bacterial cells were extracted with water at 90°C for 10 min., and the vitamin in them was determined by Euglena method. On the other hand, 56 species of the authentic bacteria were examined on their activity in the same manner.

Some of these bacteria decomposed the vitamin completely whereas others synthesized it or remained unconcerned, and the behavior or bacteria on the vitamin seemed to be species-specific. It is noticeable that *Achromobacter* and *Pseudomonus*, the common fish-spoiling bacteria, contain more decomposing species or strains. The same was true of *Escherichia coli* and *Bacillus subtilis* which usually contaminate the fish in a market.

88. Studies on the crystalline style of molluscs. I. Chemical constituents of the style of *Mactra sulcataria* Reeve. Part I. Yoshiro Hashimoto, Tokuji Sato and Kenichi Miyamoto (Bull. Jap. Soc. Sci. Fish. **20**, 406, 1954)

The general nature of the style has been investigated. The structural component of the style was confirmed to be a sort of mucin and the component sugars of it were examined by paper chromatography.

The presence of uronic acid, glucosamine, galactose, mannose, xylose, fucose and an unknown sugar was proved. The last one was supposed to be deoxyribose.

89. Chemical studies on the red muscle ("chiai") of fishes. II. Determinations of the content of hemoglobin, myoglobin and cytochrome c in the muscles of fishes. Fumio Matsuura and Kanehisa Hashimoto (Bull. Jap. Soc. Sci. Fish. **20**, 308, 1954)

Quantitative estimation of the amounts of myoglobin, hemoglobin and cytochrome c in the red and the ordinary muscles of several kinds of fishes was made, using de Duve's pyridine-hemochromogen method for hemoglobin plus myoglobin, Drabkin's method for myoglobin, and Rosenthal and Drabkin's method for cytochrome c, respectively. All the three pigments were found to be present largely in the red muscle than the ordinary muscle. Especially, the deep-seated red muscle, which exists only in the pelagic fishes such as tunny or bonito, contained about 2～4% of myoglobin plus hemoglobin. In one sample over 5% was observed. Myoglobin and hemoglobin were found approximately in equal amounts in the red muscle, while hemoglobin was rather predominant in the ordinary one. As for cytochrome c, the content was generally much less than the other two pigments, but in the deep-seated red muscle of bonito or the red muscle of saury-pike, this pigment occurred in a fairly high concentration, up to 40 mg %.

90. Chemical studies on the red muscle ("chiai") of fishes. III. Comparative studies of amino acid contents in the protein of the ordinary and the red muscle of fishes by microbiological assay. Fumio Matsuura, Shōji Kōnosu, Ryōzō Ōta, Shin-ichi Katori and Kiyoe Tanaka (Bull. Jap. Soc. Sci. Fish. **20**, 941-945, 1955)

Seventeen amino acids of the protein obtained from four species of fish, *Scomber japonicus*, *Seriola quinqueradiata*, *Parathunnus sibi* and *Katsuwonus vagans*, were determined by microbiological method, and the results obtained were tabulated.

Distribution of amino acids in the muscle protein of these fish seemed to be relatively uniform, irrespective of the species of fish and kinds of muscle. It is

noticeable that the distribution of amino acids in the protein of the superficial red muscle of fish, such as *Parathunnus sibi* and *Katsuwonus vagans*, which have the deep seated red muscle too, agreed surprisingly with those of the ordinary muscle. However, between the deep seated red and the ordinary muscle of the above two species, there seemed to be some differences, although very small, in content of several amino acids. This tendency was observed also between the red and the ordinary muscle of *Scomber japonicus* and *Seriola quinqueradiata*; glycine, leucine, phenylalanine, and perhaps proline being found in the red muscle, and aspartic acid, glutamic acid, histidine, lysine, and perhaps valine, serine, threonine, methionine, and tyrosine being found in the ordinary muscle.

From the nutritional point of view, the protein of these fish, both the red and the ordinary muscle, may be considered to be as rich as those of domestic animals in the essential amino acids.

91. Chemical studies on the red muscle ("chiai") of fishes. IV. Preparation of crystalline myoglobin from the red muscle of fishes. Fumio MATSUURA and Kanehisa HASHIMOTO (Bull. Jap. Soc. Sci. Fish. **20**, 946, 1955)

Metmyoglobin crystals were obtained from the deep-seated red muscle of fishes, e. g., *Parathunnus sibi, Thunnus orientalis* and others, by SCHMID's method. The iron content of these preparations was determined to be 0.334–0.335%, according to DRABKIN's o-phenanthroline method. Then derivatives of these myoglobin were compared spectrophotometrically with those of crystalline horse myoglobin prepared for reference. The extinction coefficients of these myoglobins were calculated and compared with the data of other authors. Absorption maxima and minima of horse myoglobin derivatives appear to be very close with those in the literature. However the absorption spectra of these fish oxy- and carbonyl-myoglobin showed distinct specific specificities: i. e., the absorption spectra of these fish oxy-myoglobins were located nearer the short wave-lengths than those of horse, and found to be present at nearly the same wave-lengths as oxy-hemoglobin, prepared from the blood of immature *Thunnus orientalis*, and also higher vertebrates. This fact goes against the usual conception that the absorption spectrum of oxy-myoglobin is shifted toward longer wave-lengths than those of oxy-hemoglobin, though the extinction coefficients differed in both. In a similar manner, the spectra of carbonyl-myoglobin of fishes were studied. The other derivatives of fish and horse myoglobins were found to be almost identical to each other.

92. Chemical studies on the red muscle ("chiai") of fishes. V. Preparation of cytochrome c from the red muscle of tunny-fish. I. Fumio MATSUURA, Shigehide YAMADA and Kanehisa HASHIMOTO (Bull. Jap. Soc. Sci. Fish. **20**, 951, 1955)

Cytochrome c preparations containing about 0.34% iron were prepared from the deep-seated red muscle of tunny (*Thunnus orientalis*) according to KEILIN & HARTREE's method, the iron being determined by DRABKIN's o-phenanthroline method. "0.43% Fe" preparations were prepared by means of Amberlite IRC-50 after MARGOLIASH, from the above-mentioned 0.34% preparations. At the same time cytochrome c preparations were obtained from the heart muscle of horse for reference. The spectral characters of tunny and horse cytochromes were then investigated. Both

in the "0.34% Fe" and in the "0.43% Fe" preparation, there were no significant differences between the spectra of these species of cytochromes; i. e., the absorption bands of these cytochromes appear at the same wave-lengths and their spectrophotometric constants are fairly close in both.

93. Studies on the radioactive material in the radiologically contaminated fishes caught in the Pacific Ocean in 1954. Masamichi SAIKI, Shinji OKANO and Takajirō MORI (Bull. Jap. Soc. Sci. Fish. **20**, 902-906, 1955)

The highest concentration of radioactivity was found in the viscera, with less in the bone, skin and muscle, as shown in figure.

With water or EDTA-Na solution, some amount of radioactive material was washed off from the raw meat effectively. The radioactive materials contained in various organs of fishes were analyzed radiochemically.

The active substance in fishes was proved to be chiefly the radioisotopes belonging to III group, whereas those belonging to IV group (Sr, Ca, etc.) was relatively little. Members of III group were further separated in A (Al, Fe, etc.) and B (Zn, Co, Ni, etc.) subgroups, and the latter fraction was found to contain also considerable amounts of radioactive materials. Zn^{65} was detected in this III B group by the gamma-ray analysis. (Fig. 1.)

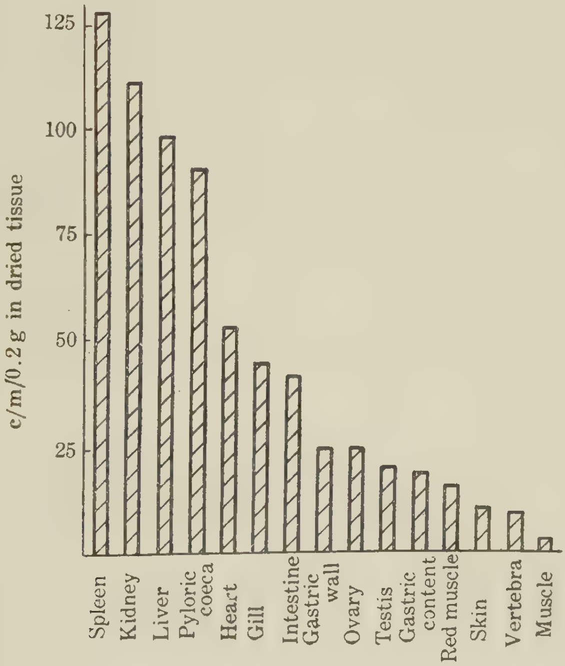


Fig. 1. Average c/m/0.2 g. in dried tissues of "SHIIRA" *Coryphaena hippurus*

Specimen: Nine fishes caught at 100 miles east off Formosa Island (Taiwan) in May, 1954.

94. Studies on the whale oil. X. Fatty acid composition of the pacific beaked whale (*Berardius bairdii*) oil. Part 4. On the liver lipid. Masamichi SAIKI (Bull. Jap. Soc. Sci. Fish. **20**, 396-400, 1954)

The liver lipid of the pacific beaked whale, which is taken from raw liver by extraction with hot alcohol, acetone and ether, contains 42.5% aceton insoluble matter, and has 15.46% unsaponifiable matter. This shows the presence of a remarkable amount of compound lipids in this lipid. The mixed fatty acids of this lipid are composed of 33.2% saturated acids (stearic 14.0%, palmitic 17.9%, and also myristic 1.3%) and 66.8% unsaturated acids (C_{14} 1.2%, C_{16} 7.4%, C_{18} 30.1%, and C_{20} and above 28.1%). The unsaturated fatty acids of C_{18} and C_{20} were separated by lithium-salt acetone method into the monoethenoid and polyethenoid acids. It was found that the C_{18} unsaturated acids were composed of 16.49% polyethenoid (I. V. 189. 3) and 83.51% monoethenoid acids. On the other hand, C_{20} acids contained 66.37% polyethenoid acids (I. V. 287. 4). The composition of fatty acids is summarized in table. Probably, this may be the first detailed data on the whale liver lipid.

This liver lipid showed the considerably different fatty acid composition from the oils of head-jaw, blubber and viscera of the same specimen as shown in table. The dominant presence of the higher saturated acids and the higher unsaturation of C_{20}, C_{22} fatty acids were recognized as a remarkable character of this liver lipid. Moreover, the liver lipid of this whale, differs considerably from the other whale oils and the common fish oils in their fatty acid composition, and rather resembles to liver fats of herbivorous land animals. (Table 1.)

Table 1. Component fatty acid (wts. per cent.) of the pacific beaked whale (*Berardius bairdii*) oil.

		Head-jaw	Blubber	Viscera	Liver
Saturated fatty acids	C_{10}	21.21	—	—	—
	C_{12}	31.94	0.34	0.71	—
	C_{14}	8.15	4.02	5.13	1.3
	C_{16}	6.43	4.48	3.71	17.9
	C_{18}	1.11	1.30	1.04	14.0
	$C_{20\sim22}$	—	—	—	trace
	Total	68.84	10.14	10.59	33.2
Unsaturated fatty acids	C_{12}	4.01 (−2H)	—	0.07 (−2H)	—
	C_{14}	3.43 (−2H)	2.08 (−2H)	2.97 (−2H)	1.2 (−2H)
	C_{16}	7.57 (−2H)	9.31 (−2H)	10.88 (−2H)	7.4 (−2H)
	C_{18}	10.34 (−2H)	26.90 (−2H)	29.69 (−2H)	30.1 (−2.4H)
	C_{20}	5.00 (−2H)	38.50 (−2.14H)	39.52 (−2.14H)	28.1 (about −6H)
	C_{22}	0.81	13.07 (−2.6H)	6.28 (>−2H)	
	Total	31.16	89.86	89.41	66.8

95. Studies on the whale oil. XI. Molecular distillation of the pacific beaked whale (*Beradius bairdii*) liver oil. Masamichi SAIKI (Bull. Jap. Soc. Sci. Fish. **20**, 401-405, 1954)

No report has ever been published on the vitamin A potency of the Pacific beaked whale liver oil. The author determined vitamin A potency of this oil as shown in table 1. This liver oil showed a remarkably high ratio, 300/328 of whole oil and low OSER's factor, showing the presence of a remarkable amount of kitol. Then this oil was distillated under the condition of molecular distillation. The total amount of recovered vitamin A in the distillate was remarkably higher than that of the original oil. (Table 2.)

Table 1. Vitamin A potency of the pacific beaked whale liver oil.

Sample No.	Potency observed (I.U.)	Ratio of whole oil		Oser's factor for correction	Potency corrected by Oser's method (U.S.P.)
		300/328	350/328		
A	82,200	1.09	0.52	0.48	34,020
B	23,110	1.93	0.35	0.16	4,140
C	4,880	1.08	0.49	0.56	2,690

Table 2. Molecular distillation of the pacific beaked whale liver oil (Sample C.)

	Temp. of bath	Yield, oil		Potency observ-ed (I.U.)	Ratio of whole oil		Oser's factor for cor-rection	Potency cor-rected by Oser's me-thod U.S.P.	Vitamin A yield calculated by (U.S.P.)
		wt. (g.)	%		300/328	350/328			
Original oil	—	280.0	(100.0)	4,880	1.08	0.49	0.56	2,690	(100.0)
F. 0	-200°C	16.2	5.8	12,550	0.86	0.58	0.65	6,190	13.3
F. 1	250°C	146.0	52.0	9,660	0.75	0.57	0.86	7,850	151.8
F. 2	270°C	42.5	15.1	11,710	0.82	0.54	0.82	8,840	49.8
F. 3	290°C	35.1	12.6	8,340	0.96	0.54	0.79	5,760	26.6
R	—	40.8	14.5	4,740	2.21	0.45	—	—	—
								Total	241.5

VI. Forestry

Abstracts Nos. 96 — 147

96. Anatomical studies on the wood of Japanese *Quercus* II. On subgenus *Cyclobalanopsis* (Kashi group). Ken SHIMAJI (Bull. Tokyo Univ. Forests **47**, 125-143, 1954)

Among the Japanese species of genus *Quercus*, seven representative species of subgenus *Cyclobalanopsis*, i.e. *Q. acuta*, *Q. gilva*, *Q. myrsinaefolia*, *Q. paucidentata*, *Q. stenophylla*, *Q. glauca* and *Q. Hondai* were studied anatomically, and:

(1) Minute descriptions on the wood-anatomical characteristics of each species were given.

(2) The processes of the ontogenetic development of the primary broad rays were investigated and it was known that all the species take one and the same process as a principle.

(3) The Japanese species of subgenus *Cyclobalanopsis* are monotypic in wood structure, while the wood of sections ILEX and SUBER of subgenus *Lepidobalanus* are common with those of subgenus *Cyclobalanopsis* in their structure, suggesting the near relation of these two sections and subgenus *Cyclobalanpsis*.

(4) The tracheary elements of *Q. Hondai* are considerably thin walled. This feature may have some influences upon the wood technological characteristics of this species among the species of this subgenus.

(5) A key to the above mentioned seven species based on the wood-anatomical characteristics is presented.

97. On the vascular system of the node and the leaf of genus *Quercus*. Ken SHIMAJI (Bull. Tokyo Univ. Forests **48**, 139-147, 1955)

The vascular system of the node and the leaf was investigated on the Japanese species of genus *Quercus*.

Although the nodal anatomy of the *Quercus* was stereotyped and constant throughout the genus, having trilacunar node with 2/5 phyllotaxis, there were two significant trends of structural specialization of the vascular system of the petiole and lamina.

These trends were parallel to the two major types of wood structure of the genus which were indicated by the author in the previous papers.

98. Notes on Japanese ferns (2-5). Satoru KURATA (Hokuriku Journ. Bot. **3**, 62-65, 80-83, 1954; **4**, 14-17, 43-44, 1955)

From the taxonomical phytogeographical view-points, critical notes are given on such ferns as *Athyrium Sheareri*, *Dryopteris commixta*, *Elaphoglossum Yoshinagae* (new to Kyushu), *Polystichum Kurokawae*, *Polystichum pseudo-Makinoi* (new to Central China), *Rumohra nipponica*, *Vittaria Fudzinoi*, *Vittaria zosterifolia* (new to Shikoku), *Woodsia subcordata* (new to Japan), *Athyrium clivicola* (new to Korea), *Dryopteris laeta* (new to Honshu), *Poly-*

stichum igaense, *Polystichum polyblepharum* var. *fibrilloso-paleaceum*, *Polystichum polyblepharum* var. *intermedium* (stat. nov.), *Polystichum rigens* (new to Central China), *Athyrium frangulum* form. *viride* (form. nov.), *Dryopteris Tasiroi* and *Lepisorus Uchiyamae*.

99. Some taxonomical notes on Thymelaeaceae from Japan and the adjacent regions (1). Toshio HAMAYA (Journ. Jap. Bot. **30**, 33-38, 1955)
1. On *Daphne* sect. Mezereum SPACH.

In these regions the following five species have been described: *Daphne pseudo-mezereum* A. GRAY, *D. kamtschatica* MAXIM., *D. jezoensis* MAXIM., *D. koreana* NAKAI and *D. rebunensis* TATEWAKI. The writer reexamined the characteristics used to distinguish them, and tried to find other new characteristics. The results are as follows. Firstly, the flowers are dioecious, probably in all species; male flowers are large and female ones small in the same species. It is considered that *D. rebunensis* must have been described on the basis of such female plants of *D. jezoensis*. The position of the stamens and the ratio of the lobes to the calyx-tubes in length are significant, too. Secondly, the lateral veins of the leaves are poorly developed in *D. pseudo-mezereum*, while in the other two better developed. Thirdly, the growing habit of plants in this section is conspicuous by the summer-deciduousness in the normal condition. But there have been observed some eccentric examples. *D. koreana* which was described as a winter-deciduous species by NAKAI may be only one of such examples in *D. pseudo-mezereum*.

In conclusion, a key is given to lead to the three remaining species, namely *D. pseudo-mezereum* (incl. *D. koreana*), *D. jezoensis* (incl. *D. rebunensis*) and *D. kamtschatica*.

100. Contributions to the Japanese Fungous Flora III. Toshio SASAKI (Bull. Tokyo Univ. Forest **47**, 145-153, 1954)

Six species of wood-rotting fungi, namely *Cytidia salicina* (FR.) BURT., *Stereum sanguinolentum* (ALB. et SCHW. ex. FR.) SCHW., *St. vibrans* BERK. et CURT., *St. pendulum* SASAKI, sp. nov., *Fomitopsis sensitiva* (YASUDA ap. LLOYD) SASAKI, comb. nov. and *Bondarzewia montana* (QUEL.) SING., are described.

101. Nitrogen absorption and amino acid formation by *Fusarium solani* MART. APP. et WR. Shun-ichi YOKOTA (Bull. Tokyo Univ. Forest **47**, 155-161, 1954)

The absorption of nitrogen from five kinds of nitrogen sources and the corresponding amino acid formation in fungus mycelia of *Fusarium solani* were examined and discussed.

The rate of absorption measured with the KJERDAHL method was the greatest of all with NH_4Cl and the weight of dried mycelia was the greatest with glycine. Twelve spots of known amino acid were detected and an unknown spot sensitive to the ninhydrin reagent was detected in every case.

102. On some phenomena in the development of *Fusarium lateritium* (NEES) SNYDER et HANSEN, when asparagine and ammonium nitrate are supplied as the nitrogen source. Shun-ichi YOKOTA (Bull. Tokyo Univ. Forest **47**, 163-172, 1954)

The effect of asparagine and NH_4NO_3 on the development of *Fusarium lateritium* was investigated. The weight of mycelia and the change of pH values were measured in every 10 days during the 30 days' incubation at 27°C. At the same time, the

qualitative analysis of amino acids by means of the paper partition chromatography was carried out, but no marked difference of their kinds corresponding to asparagine and NH_4NO_3 could be recognized.

103. Wood decay of *Abies sachalinensis* forests in Tokyo University Forest in Hokkaido. Toshio SASAKI and Shun-ichi YOKOTA (Miscellaneous Information, the Tokyo Univ. Forest **10**, 15-21, 1955)

372 out of 549 of *Abies sachalinensis* were found decayed (67.7%) in the total surveying area of 1.25 ha., especially showing a high percentage of wood decay (87.6%) in the group of the breast height of diameter over 40 cm (71 out of 81 were decayed).

Most of the decays were so called "root-rot type" due to the attack of *Fomitopsis annosa* and *Phaeolus Schweinitzii*, etc. The damage caused by *Phellinus Hartigii* was not so much as that of the root-rot type.

According to the fact that the damage is smaller when the density of trees is sparse, a probability to reduce the damage by taking a proper improvement of the forest is suggested.

104. The amino acids in the pollen and female flower of *Pinus Thunbergii* Ken-ichi HATANO (Bull. Tokyo Univ. Forests **48**, 149-152, 1955)

The pollen and the female flowers of *Pinus Thunbergii* were analysed qualitatively by the technique of partition paper chromatography. Arginine, glutamic acid and proline were predominant in twelve free amino acids of the pollen; as the protein-constituting amino acids, twelve amino acids and an unknown substance were found. There were in the female flower, ten amino acids and two unknown substances in the free state, and fourteen amino acids and an unknown substance in the protein. The content in the pollen of *Pinus densiflora* was similar to that of *P. Thunbergii.*

105. On the range of attraction of the fluorescent lamp for the May-beetle. (II). Masatoshi NITTO and Kanji TACHIBANA (Journ. Jap. Forestry Soc. **36**, 234-235, 1954)

The relationship between the degree of positive reaction that is shown for the fluorescent lamp by the May-beetles, and the distance to it from them was studied. The observations were made in the field using a deviced black chamber by which probably the meteorogical and topographical interferences and any other effects was avoided. The limit of distance beyond which no reaction was observed was supposed to be at a distance of about 220 m (ranging 175~250 m) fluorescent lamp by this work.

106. On the chestnut varieties resistant to the chestnut gall wasp (*Dryocosmus kuriphilus* YASUMATSU). Masatoshi NITTO and Kenzo SHIMIZU (Bull. Tokyo Univ. Forests **47**, 173-188, 1954)

It has been accepted these past several years that many individuals of the chestnut varieties apparently exhibit resistance to the attack of the chestnut gall wasp (*Dryocosmus kuriphilus* YASUMATSU), and that the resistance appears during the egg and larval stage of it, not resulting from its avoidance of the egg-laying against

their resistance.

According to reports in reference to resistance of several varieties from different localities, however, some individuals of a variety in a locality are resistant, whereas on the contrary others in a locality are susceptible, in spite of belonging to the same variety, and to what cause their resistance was due are not known. If the resistance is directly influenced by site condition, the widespread planting of resistant varieties will become impracticable by the attack of the wasp.

In order to solve such problems and find out new resistant varieties, we have examined the resistance of varieties collecting as much as possible from different localities.

Here in this paper we dealt with a part of the result which we had obtained.

(1) In order to examine susceptibility of chestnut varieties we have made the wasp lay her eggs into buds by using lawn-bags. But we could not obtain satisfactory results. The oviposition for the whole test trees amounted to only 41.7%. When as a substitute for lawn-bag, the plants were covered with the wire screen cages, good results were acquired.

(2) In compulsion of oviposition under the lawn-covers, a little more eggs were laid on the susceptible varieties than on the resistant ones.

(3) For the purpose of oviposition, the wasp chooses mainly buds situated somewhere from the 9th to the 15th from the top of a shoot, and buds eggs containing a decrease towards the termination and the base in number.

(4) We could select 46 resistant varieties among 135 species and varieties as shown in the appendix, the resistance of many of which had not been known exactly.

(5) Both resistant and susceptible varieties showed almost the same number of fallen buds, and we could not recognize that the buds in the former were larger in number than in the latter.

(6) Tall and vigorous trees have a tendency to form more abundance of galls.

(7) In the fertilization experiments, each one of the three elements (N.P.K.) and the combination of them seem to have no effect upon resistance itself of the chestnut varieties.

(8) The wild Japanese chestnut has been recorded as a susceptible species, but we found out many resistant individuals among them.

107. Materials for the studies of growth in stands. 1. Young stands of Japanese red pine of various density. Taisitiroo SATOO, Kentaro NAKAMURA and Masazi SENDA (Bull. Tokyo Univ. Forests **48**, 65-90, 1955)

Different phases of growth of the Japanese red pine (*Pinus densiflora*) stands of various densities, were analysed in the Tokyo University Forest in Tiba Prefecture. One-year-old seedlings were planted in 1938. The original spacing of the plantation was 0.5, 1.0, 1.5, and 2.0 m, and the density at the time of the first survey, in 1950, was 12806, 7411, 4099, and 2412 trees per 1 ha., respectively. The survey was carried out in the autumn of 1950 and additional data were collected in the summer of 1953. As the comparison of the diameter at their third year and the height in 1950 and in 1953 showed no significant difference amongst the four plots, the site quality of each plot was presumed to be nearly equal. Average diameter at breast height, volume of stem and its annual increment per tree, volume of branches per tree and per unit area,

size of crown, live crown ratio, amount of needles per tree, ratio of branch to stem, and estimated amount of branches already lost, etc. decreased with increasing stand density. Mortaliy, basal area and volume of stem per unit area, surface area of stem and estimated amount of branches already lost per unit area, form factors of the stem, percentage of stem volume in the total volume (stem plus branches), annual stem wood production per unit weight of needles, the ratio of needles to branches etc. increased with increasing stand density. Height, volume of total wood and amount of needles per unit area were not affected by the stand density. The influence of stand density, on current annual growth of stem per unit area, was not obvious and needs further study. Not only the logarithm of the diameter, as shown by REINEKE, but also that of cross sectional area at breast height, volume of stem, of branches and of total wood, amount of needles, and weight of tree without root, per tree, showed linear relation with the logarithm of the number of trees per ha. Vertical distribution of needles nd branches differed with stand density. The ratio of the weight of needle to branches was higher in the upper layers of crown and decreased downwards. The course of diameter growth was influenced by stand density, decrease in diameter growth due to crown closure occurred earlier in the denser stand. The widest annual ring was found at first in the base of stem and then gradually moved upwards with the age of the stand, and the movement was faster in the denser stand. The amount of needles per 1 ha. was estimated as 12-13 metric ton, regardless of stand density.

108. An instance of soil moistuer tension in bare land in summer. Taisitiroo SATOO and Ziroo NAMURA (Journ. Jap. Forest. Soc. **37**, 253, 1955)

In August, 1950, soil moisture tension was determined directly by modified HANSEN's method on samples from bare hill-side where sheet erosion is on progress. Soil moisture tension sometimes exceeded 15 atmospheres, and light rainfall was not so effective as to wet the deeper layers.

109. Seed maturity and germination power. Masasi GOO and Haruka HIRAMATSU (Bull. Tokyo Univ. Forests **48**, 103-114, 1955)

Some phases of ripening of seeds of *Cryptomeria japonica, Chamaecyparis obtusa, Pinus densiflora* and *Pinus Thunbergii* were studied in 1952 and 1954. (1) The course of change in moisture content of cones was similar in both years, and it was divided in the three stages: (i) Quick decrease until the germination power of seed appeared for the first time after the fertilization, (ii) Slow or minimum decrease until the seed disperse, (iii) Quick decrease before dispersal. (2) Moisture content of seeds was quickly decreased from the time of fertilization to the stage when germination occurred for the first time, and it slowly decreased until the seeds disperse.

(3) The fertilization of *Cr. japonica. Ch. obtusa. P. densiflora* and *P. Thunbergii* was in the last decade of June or the first decade of July.

From the germination test it will be seen that the germination power of seeds of tree gathered on Oct. 3, Oct. 14, Oct. 29 and Nov. 14 did not show any difference, whereas seeds gathered on Aug. 13, were very poor and slow in germination. From

the morphological observatiin it was found that the embryonic differentiation was completed from Aug. 13 (*Cr. japonica*) to Sept. 1. (*P. densiflora* and *P. Thunbergii*).

110. Origin and development of adventitious roots in seedling cuttings of conifers (II). Seizaemon SATOO (Bull. Tokyo Univ. Forests **48**, 115-128, 1955)

Origin and development of adventitious roots were studied in cuttings of young seedlings of *Taxus*, *Torreya*, *Larix* and 5 species of *Pinus*. Every 2-5 days after planting 4-5 cuttings were removed from rooting media at random and the majority of the basal portions of them were fixed in ALLEN's fluid. Increase in the number of root primordia and roots after planting in *Pinus densiflora* and *P. strobus* are shown in Table 2. Other points of material and method in this experiment were the same as in report I.

In *Taxus cuspidata* and *Torreya nucifera* most of the adventitious roots arose from callus tissues in the same manner as in *Cryptomeria, Thujopsis, Thuja* etc. but some of the roots in *Taxus* developed from the irregularly arranged parenchymatous phloem layers near the cut base as in *Abies* and *Picea*.

All of roots in *Pinus densiflora P. Thunbergii, P. silvestris, P. pinaster*, and about 6/7 of roots in *P. strobus* arose from callus in the same manner as callus-roots observed until now, but about 1/7 of roots in *P. strobus* arose in connection with bud-primordia. Exogenous origin of callus-roots in *Pinus densiflora* cuttings reported sometime ago should be corrected by the results of this observation, because callus-xylem is connected with the developing root meristem.

In *Larix Kaempferi* cuttings the roots arose in connection with bud-primordia and leaf-traces.

111. Origin and development of adventitious roots in iuttings of *Chamae cyparis obtusa*. Seizaemon SATOO (Journ. Jap. Forest. Soc. **36**, 355-359, 1954)

Origin and development of adventitious roots were observed in cuttings taken from 6 years old *Chamaecyparis obtusa* seedlings. Almost all adventitious roots developed from the ordinary uniseriate rays, unusual wide uniseriate rays and unusual bi-to triseriate rays between the outer portion of xylem and cambium-phloem region. Four callus-roots were observed, but no root primordia was observed.

112. The effect of detachment on apparent photosynthesis of Akamatu (*Pinus densiflora*) and Matebasii (*Lithocarpus edulis*) seedlings. Ken'itiroo NEGISI and Tai-sitiroo SATOO (Bull. Tokyo Univ. Forests **48**, 129-138, 1955)

The effect of detachment on the rate of apparent photosynthesis was studied with 1-year-old seedlings of Akamatu and yearling Matebasii. The observations were made under five different conditions as follows: experiment 1, detached shoot, cut surface of it was dipped in water just after cutting, ex. 2, detached shoot lacked supply of water, ex. 3, detached shoot, whose cut surface was attached compactly to a rubber tubing through which water with pressure was supplied from the reservoir put on higher place, ex. 4, intact seedling, lifted from soil and the root washed and dipped in water carefully, ex. 5, detached shoot same as ex. 1, but another condition differed as described later.

Results of ex. 1 and 2 showed that the photosynthetic rate of a detached shoot

decreased considerably after 1 to 2 hours following detachment, while that of an intact dug plant (ex. 4) had kept original rate of photosynthesis for a long time. The beginning of depression was more faster in ex. 2, especially in the case of Matebasii, compared with ex. 1. The change in weight of a detached shoot that indicates theh water condition of it was parallel with the time course of photosynthetic rate after detachment in many observations, and the presence of a connection was supposed between them.

The change in water content of a detached shoot is related to unbalance between transpiration and absorption, and remarkably high rate of transpiration just after the detachment is connected with initial depression of weight. If the water content is a cause of the change of photosynthetic rate after detachment, it is probable that the degree of depression of the rate was reduced by any way of keeping the water content as constant. In ex. 3 water with pressure was supplied to the cut surface of a shoot to increase the rate of absorption of water, and in ex. 5 the detached shoot was placed in assimilation chamber in which air humidity was very high, nearly at 100 per cent, to decrease the rate of transpiration. Both methods of keeping the water content lengthened a time in which the photosynthetic rate is unchangeable.

113. Soil moisture in relation to apparent photosynthesis and respiration of Akamatu and Sugi seedlings. Ken'itiroo NEGISI and Taisitiroo SATOO (Journ. Jap. Forest. Soc. **37**, 100-103, 1955)

The authors have studied the relation between soil moisture content and rate of apparent photosynthesis under field conditions in 1952 and under controlled conditions in 1953. In this paper more cautious observations were carried out to ascertain the results of these previous works and to fill up any defect in them. The experiments in 1954 were made with 1-year-old, pot grown seedlings of Akamatu (*Pinus densiflora*) and Sugi (*Cryptomeria japonica*) under controlled conditions.

The deficient amount of soil moisture resulted in subnormal rates of apparent photosynthesis and similar difference as like as reported previously was observed between the species, concerning the influence of soil drying on them; for Sugi no change in photosynthetic rate happened with some decrease in soil moisture below the field capacity and then marked reduction occurred, for Akamatu, on the other hand, a reduction happened immediately with a slight decrease below the field capacity, but the rate of depression was less prompt in comparison with Sugi. As a cause of this difference, it is supposed that under brought the water economy of Akamatu is more economical than that of Sugi. Theh effect of excessive amount of soil moisture on photosynthesis was remarkable for Akamatu. Both excessive and inadequate is more economical than that of Sugi. The effect of excessive amount of soil moisture amount of soil moisture caused subnormal rates of respiration.

When water was supplied to the soil in which seedlings under drought were grown, the rate of photosynthesis increased soon. The process of recovering was differed by a difference in the degree of soil drying and/or in the species.

114. Note on the Brian HACKETT'S articles—Scops for the development of landscape design. Junichiroo MAENO (Journ. Jap. Inst. Landscape Architects **18** [1], 9-14, 1954)

Some of the recent movements in the European countries' landscape architecture, including England, and also the problems therein involved were studied by Brian HACKETT of the University of Durham.

He has interested himself and taken the work of, (1) an instructor of landscape design and education in town and country planning, (2) a research scientist on the historical development of the planning theory, and (3) a critic on landscape architecture.

He strongly holds the view for the necessity of the development of landscape design, and he insists upon the need of a landscape designer, of a new kind, who can think of the landscape interms of land-use as well as its aesthetic value and can handle landscape problems on a regional scale: for instance the maintenance of an ecological balance in land use alternation, the assimilation of agriculture and afforestation into a productive landscape, etc.

This very broad interpretation of landscape architecture or design, has won wide appreciation all over the world. It is required that a technique be developed for a large scale and conscious landscape treatment which oculd be adapted in our country Japan.

115. The Management and Labour System of SOMAYAMA in NARA era. Michio TSUTSUI (Bull. Tokyo Univ. Forests **48**, 1-41, 1955)

In NARA era, many temples were built; "TODAIZI" was one of them. In this era, a temple was composed of a "HONZI" (main temple) and some "MATSUZI" (branch temples), "ISHIYAMADERA" was one of "MATSUZI" of TODAIZI. In this report, the system of supplying of the material, fund and labour, in construction of "ISHIYAMADERA" is studied. The kind and characters of labour, the sources of funds and its distribution type, and the study of the characteristics of the account, in the construction of "ISHIYAMADERA" under the "RITSURYO" administration system (the new administration system which was adopted from "TAIKA" ages) are the objects of this study.

The results obtained by this study are as follow:

1. The building materials—lumber—came from KOGA NO SOMA and TANOKAMI NO SOMA (the granted forest to TODAIZI from the RITSURYO government).

2. Management agencies were "ZO-TODAIZI NO TSUKASA" and "ZO-ISHIYAMADERA DOKORO" which was set up under the national account.

3. In each department of the government of "RITSURYO ADMINISTRATION SYSTEM", the following four classes of organization (KAMI, SUKE, JYO and SAKAN) were established. Chief of "ZO-TODAIZI NO TSUKASA" was KAMI, and chief of "ZO-ISHIYAMADERA DOKORO" was SAKAN.

4. Labour system consisted of RYO (master of labourers), SHIKO (fixed employee), YATOIKO and YATOIFU (free employee) and SHICHYO (tributary labourer).

5. Free employees were more in number than fixed employees and SHICHIYO were about 10 percent of the total.

6. Funds came from "SOMAI" (the rice which was paid as duty by farmers in "HOKO"—granted land to TODAIZI from the RITSURYO government).

7. In this era, the chief economic system was natural economy, therefore in

most cases funds were not paid in money but in food to "TANOKAMI NO SOMA" from "ZO-ISHIYAMADERA DOKORO".

116. How to estimate the uplifting of the multiple-span logging cable at an intermediate supporting point. Seihei KATO (Trans. 63rd Meeting, Jap. Forestry Soc. 251, 1954)

The cable of a mutiple-span skyline shows in some cases the uplifting phenomena, which should be necessarily avoided, at it's intermediate supporting points. This phenomena is related to the conditions of the cable arrangement and also to the situation and weight of the carriage load. The author analysed the phenomena, and derived some theoretical formulae for the calculation of uplifting, by which any adequate designe of the cable arrangement may be obtained.

117. Studies on the skyline logging cables for their planning and inspection. Seihei KATO (Bull. Tokyo Univ. Forests **49**, 1-157, 1955)

The theory and practice of skyline logging cable are described in this report. The author has established a basic theory of the skyline cable, the adequacy of which has been proved by numerous experiments performed by him. Applying the theory to the practical problems of the skyline cables used in logging operation, new methods of planning and inspection of the cable installations were investigated.

The author concluded as follows:—

(1) The theory of the "*Parabolic cable*" is practically preferable for the basic theory of the logging skyline cables.

(2) The reliability of the author's basic formulae of the "*Parabolic cable*" is sufficient. But, in most cases, the displacement of the supporting points, the elastic elongation of the cable and the temperature change should be taken into account.

(3) The author's "*Corrective formulae*" for these additional conditions proved to be applicable.

(4) The effects of impact should be taken into account, and the use of the "*Impact coefficient*" is advisable.

(5) The ecects of the hauling cable should be taken into account, and the use of the "*Coefficient of the hauling cable*" is also advisable.

(6) The results of these fundamental studies can be practically utilized for the planning of the skyline cable with a traveling carriage-load.

(7) For inspection of tensioning of the skyline cable, the measurement of the inclination of the cable at the supporting point is advantageous.

(8) The "*Vibration wave method*" is very useful and practical for inspection of the cable tension and judgement of the safety factor.

(9) The results of the author's theoretical investigations on the cableways with multiple-loads showed the adequacy of the "*Uniform load method with equivalent sag-span ratio*" based on the newly derived multi-loads maximum tension formula.

(10) This theory is practically applicable and preferable for the planning of the skyline cable loaded with any number of carriage-loads.

118. How to estimate the tension of the skyline cable with multiple concentrated loads on it. (I) The general solution. Seihei KATO and Takao HORI (Journ. Jap. Forestry Soc. **36**, 339-343, 1954)

For the installation of the logging skyline cableways, accurate estimation of the cable tension is required.

The estimated values of the tension should be more accurate than those that may be obtained by the usual uniform load method, especially when several heavy carriage loads are applied along a span. In this report, the authors suggested a new maximum tension formula for the general case, i.e. the skyline cable is loaded with any series of the carriage loads.

119. How to estimate the tension of the skyline cable with multiple concentrated loads on it. (II). Seihei KATO and Takao HORI (Journ. Jap. Forestry Soc. **36**, 362-364,

Applying the general formula note in Report (I) to the case of the skyline cable carrying two equal concentrated loads, the theoretical maximum tension formula for that special case was given by the authors.

Quite independently, the authors also suggested a semi-empilical formula, for the same case, based on the model skyline cable experiment.

The formulas were compared with the usual uniform load formula, and the adaptability of these three formulas were discussed. As a result, the superiority of the theoretical formula was recognized.

120. How to estimate the tension of the skyline cable with multiple concentrated loads on it. (III) Equivalent uniform load method and uniform load method with equivalent sag-span ratio. Seihei KATO and Takao HORI (Journ. Jap. Forestry Soc. **37**, 5-13, 1955)

To avoid the troublesome procedures of calculating numerical values of the maximum tension given by the author's theoretical formula, at first, the method of the equivalent uniform load was applied. The accurate theoretical formula for the coefficients of equivalency was mathematically derived, then it was reduced to the approximate practical formulas. The numerical values of the coefficients were calculated for the case of the skyline cable carrying 1, 2, 3, and 4 esually spaced concentrated loads of equal weight, by which the authors realized that the previously used undesirable amounts, as errors. Also they discussed about the numbers and the spacing of the loads, both of which are closely correlated to the maximum tensions of the cable.

On the next step, the authors' maximum tension formula was further investigated, whence it found that, if the "equivalent sag-span ratio" is taken into account, the calculation can be more easily performed by the formula with the coefficient of say-span ratio equivalency.

Thus the authors reached to the conclusion, that the "Uniform load method with equivalent sag-span ratio" may be the most adequate method to be applied for the estimation of the tension of a skyline cable with any carriage load or with any series of carriage loads.

121. Tension of the skyline cables measure by the vibration method. Yoshitaka NARUSE and Shoji OKAWARA (Tokyo Univ. Forests Misc. Inform. **10**, 49-53, 1955)

To assure reliability of the vibration method for presuming the tension of the skyline cables, the authors carried out some field experiments on several cable ways, installed at Chichibu and Okutama districts. They found that the comparative relative errors of tension values computed by the vibration method to corresponding theoretical results were usually within several percents.

In this sense the vibration method may be practically utilized.

122. A study of storm hydrograph. Sadao OGIHARA (Bull. Tokyo Univ. Forest **47**, 65-90, 1954)

Rainfall is the source of river water. It is characterized by not only the amount and duration but also by the change of intensity. Practically the full record of a rainfall is obtained by the use of a self-recording rain gauge.

Very few reports have refered to the relation between rain and river discharge in their full forms. In this paper the writer has endeavoured to derive a basic formula for a storm hydrograph from the time and intensity record of rainfall.

With regarded to rain the relation between its intensity r and the time t is expressed by Fourier's reries as

$$r=\sum_{s=0}^{n}\left(c_s \cos s\frac{2\pi}{T_r}t+d_s \sin s\frac{2\pi}{T_r}t\right)\cdots\cdots(1)$$

where r=intensity of rain at t

T_r=duration of rain

$c_s,\ d_s$=constants ($s=0,\ 1,\ 2,\ \cdots\cdots,\ n$)

Next, to obtain the basic formula the writer assumed the idea "equal water travel time" for a watershed, which resulted in the following formula

$$a=\sum_{s=0}^{m}\left(a_s \cos s\frac{2\pi}{T_a}t+b_s \sin s\frac{2\pi}{T_a}t\right)\cdots\cdots(2)$$

where a=area from which water reaches the gauging station spending a travel time t

T_a=the travel time required for water to reach from the extreme point in watershed to the gauging station

$a_s,\ d_s$=constants ($s=0,\ 1,\ 2,\ \cdots\cdots,\ m$)

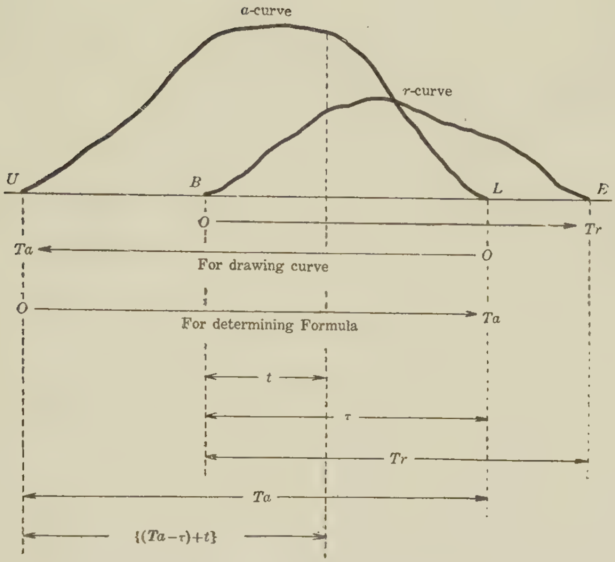
The figure shows r-curve for Formula (1) and a-curve for Formura (2), each having t-axis on a common horizontal line. In drawing these curves a-curve is drawn from L to U, while r-curve from B to E. Let the time length between B and L be τ. Then the figure shows the situation at the time τ after the begining of rain and the amount of discharge at this time at L, where the gauging station is located, is calculated as the sum of $a\times r$ between B and L. When a and r are illustrated by histogram, the calculation can be carried out very easily by a step method.

In obtaining discharge-time curve we have to operate integration $\int_0^\tau ardt$. For this purpose, the following procedure must be followed;

1st the formula for a-curve must reverse the time at L and U thus making U time zero L time T_a,

2nd t in Formura (2) thus reversed must be replaced by $\{(T_a-\tau)+t)\}$ in order to transfer origin from U to B, thus Formula (2) becoming

$$a=\sum_{s=0}^{m}\left\{a_s \cos s\frac{2\pi}{T_a}(\tau-t)+b_s \sin s\frac{2\pi}{T_a}(\tau-t)\right\}\ \cdots\cdots(2')$$



The discharge at τ (time measured from the begining of rain) is given by

$$Q_\tau = C\int_0^\tau ar dt$$

where C=run-off coefficient. Hence, substituting (1) and (2′), we get

$$Q_\tau = C\int_0^\tau \sum_{s=0}^{m}\left\{a_s \cos s\frac{2\pi}{T_a}(\tau-t)+b_s \sin s\frac{2\pi}{T_a}(\tau-t)\right\}$$
$$\times\sum_{s=0}^{n}\left(c_s \cos s\frac{2\pi}{T_r}t+d_s \sin s\frac{2\pi}{T_r}t\right)dt \cdots\cdots (3)$$

The above is the formula of **1st type** for the discharge-time curve.

When we adopt ZOCK's idea (R. T. ZOCK: On the relation between rainfall and stream flow. Monthly Weather Review, I934) that the run-off q (cm/sec) is proportional to water storage ϕ (cm), namely

$$q = c\phi \cdots\cdots (4)$$

where c=constant, a formula of another type can be derived in the following way.

The relation among r, q and ϕ is expressed by

$$d\phi = r\,dt - q\,dt \cdots\cdots (5)$$

where $d\phi$=increment of water storage during dt

r=intensity of rain (cm/sec).

Then, from (4) and (5)

$$\frac{d\phi}{dt}+c\phi = r \cdots\cdots (6)$$

Since (6) is a differential equation of linear type, it can be solved as

$$\phi = e^{-\int c dt}\left(\int r e^{\int c dt} dt + K\right) \cdots\cdots (7)$$

Putting (7) into (4),

$$q=ce^{-ct}\left(\int re^{ct}dt+K\right) \quad \cdots\cdots(8)$$

Replacing r by the right hand portion of (1), we have

$$q=K_0e^{-ct}+\sum_{s=0}^{n}\frac{c}{c^2+s^2k_r^2}\{(c_sc-sd_sk_r)\cos sk_rt +(sc_sk_r+d_sc)\sin sk_rt\} \quad \cdots\cdots(9)$$

where $k_r=\frac{2\pi}{T_r}$; $K_0=q_0-\sum_{s=0}^{n}\frac{c}{c^2+s^2k_r^2}(c_sc-sd_sk_r)$ and q_0 is the value of q when $t=0$.

In the same manner as (3)

$$Q_\tau=C\int_0^\tau aqdt$$

By substituting (2′) and (9), we get the desired formula of **type 2**

$$Q_\tau=C\int_0^\tau \sum_{s=0}^{m}\{a_s\cos sk_a(\tau-t)+b_s\sin sk_a(\tau-t)\}\Big[K_0e^{-ct} +\sum_{s=0}^{n}\frac{c}{c^2+s^2k_r^2}\{(c_sc-sd_sk_r)\cos sk_rt+(sc_sk_r+d_sc)\sin k_rt\}\Big]dt \quad \cdots(10)$$

where $k_a=\frac{2\pi}{T_a}$.

Regarding both (3) and (10) Q_τ can be expressed by a function having single variable τ, as each term obtained by operating multiplication in the right hand portion of the equation is integrable.

The above two formulae are applicable to the case shown in the preceding figure where B and L are located between U and E. In other cases care must be taken for the limits of integration.

123. A study on the method of finding the effect of forest cutting or forest growth on run-off. Yooichi NOGUCHI (Bull. Tokyo Univ. Forest **47**, 91-110, 1954)

This paper deals with the principle of control area method in forest and water experiments and its illustrative examples. Data of some well known experiments are used besides those of the Tokyo University Forest.

In the formula of run-off regression

$$\hat{R}=aP+b,$$

if a is assumed approximately to be 1;

in single area method

$$\sum(R-\hat{R})^2 \doteqdot \sum l^2,$$

in control area method

$$\sum(R_T-\hat{R}_T)^2 \doteqdot \sum(R_T-R_C)^2-\frac{(\sum R_T-\sum R_C)^2}{n},$$

where R: run-off, P: precipitation, a, b: constants, $\hat{R}$: regression of run-off, $\bar{l}$:average of losses, l : deviation of losses, i. e. $l=L-\bar{l}$, L: losses$=P-R$, n: number of years or months, suffix C and T show the control area C and treated area T respectively. In other words, the variance of run-off of its own is approximately equal to the variance of losses of respective area, or to the variance of diffirence between run-offs on control and treated areas. By these formulae the calculation of variance is much simplified. Accordingly the F test of variance ratio about two periods before and after cutting of forest is easily done.

124. Analysis of dry day hydrograph. Yooichi NOGUCHI and Jun KATAOKA (Journ. Jap. Forestry Soc. **36**, 373-376, 1954)

Runoff, precipitation and other data essential to forest and water experiments have been obtained in Tokyo University Forest at Seto in Aichi for nearly thirty years. By using the data of dry days namely hydrographs when there is no rainfall, it is found that twelve hour depletion ratios of daytime and night show clearly different values, and that a little rise instead of recession of runoff is sometimes seen at night in spite of no rainfall. It seems to have some relation with the fact that the normal depletion curves which are obtained separately from summer and winter season are different from each other, recession of winter being very slow. Groundwater storage curves correspondent to both normal depletion curves are derived, and summer season is found to have larger daily groundwater runoff rate than winter season if same storages are expected.

125. On problems in the making of a unit hydrograph. Yooichi NOGUCHI (Misc. Inform., Tokyo Univ. Forests **10**, 55-68, 1955)

This is a study of making unit hydrograph. Data of discharge are obtained by stream gauging. The water level in the pool behind gauging dam is measured and then the discharge is calculated as the outflow from the dam. But the time-outflow curve does not show the natural condition of watershed because of the water controlling function of the gauging pool, so that the time-inflow curve is first derived according to the method of O. EKDAHL. In doing so, some problems on the breadth of the notch and water controlling function of the pool are studied. When the data of discharge from a given watershed is obtained, a study is made on the separation of hydrograph into the ground water and the surface run-off.

As the result of making unit hydrographs (distribution graphs) for Experimental Watershed ANANOMIYA in Tokyo University Forest in Aichi, the following conclusions were derived at:—

(1) The distribution graphs obtained from a watershed do not always coincide with each other. This reason might be attributed to the imperfection of the method, especially of the procedure in separating hydrograph into the ground water run-off and the surface run-off.

(2) Time difference between both peaks of inflow and outflow is 17 minutes at average, ranging from 4 to 35 minutes and it has a reverse correlation with the height of peakflow.

(3) The peak of distribution graph seems to show a gradual rightward movement for a long period, perhaps by the effect of forest growth.

After the study the writer feels that further study is necessary on the method of making unit hydrograph before it gains a value of practical application.

126. Rational run-off corresponding to precipitation in any period. Yooichi NOGUCHI (Journ. Jap. Forestry Soc. **37**, 59-62, 1955)

The source of run-off is the rainfall which falls more or less previously in a watershed. So the precipitation and run-off measured at the same time or in the same period do not correspond with each other quantitatively. For example, the monthly run-off often does not deserve to be compared with the monthly precipitation.

With the aid of the recession curve of non precipitation days in Tokyo University Forest in Aichi, the writer derived the formula of the adjusted runoff of any period $R_{(1)}$ as follows,

$$R_{(1)}=R_1-S_1+S_2\,,$$

where R_1: run-off of any period,
S_1: the integration of daily runoff in the normal depletion curve ($Q=Q_0\cdot K^t$) from the time which has the equal daily runoff to that of the first day of the concerned period to infinity,
S: the integration of the same thing from the time which has the equal daily runoff to that of the first day of the following period to infinity.

By applying this formula to monthly data of the Tokyo University Forest in Aichi, the writer has found that the adjusted monthly runoff is closely connected with the monthly precipitation which has not been necessarily emphasized till now. It can be said, in the bargain, that monthly losses of summer and winter show some discrepancy, and that the runoff ratio to precipitation in summer seems about 20% less than in winter.

127. A study on the formula of the maximum flow. (1). Isao YAMAGUCHI (Bull. Tokyo Univ. Forest **49**, 159-178, 1955)

Calculation of the maximum flow is most commonly performed with the aid of the following formula

$$Q_{\max}=CAh\times 60^{-2} \quad\cdots\cdots(1)$$

where C: coefficient of run-off,
A: watershed area,
h: maximum hourly rainfall.

There is a question whether the maximum hourly rainfall is adequate to all watersheds of different sizes.

Now, under the assumption of the idea "equal water travel time" for a watershed, the writer uses the following basic formula,

$$a=a_0+a_1\cos\frac{2\pi}{T_a}t+b_1\sin\frac{2\pi}{T_a}t \quad\cdots\cdots(2)$$

where a: area from which water reaches the gauging station spending a travel time t,
T_a: the travel time required for water to reach from the extreme point in watershed to the gauging station,
a_0: average area with respect to the water travel time,
a_1, a_1: constant.

$$r=c_0+c_1\cos\frac{2\pi}{T_r}t+d_1\sin\frac{2\pi}{T_r}t \quad\cdots\cdots(3)$$

where r: intensity of rainfall,
T_r: duration of rainfall,
c_0: average intensity,
c_1, d_1: constant.

Theoretically the maximum flow can be derived from formula (2) and (3) as

$$Q_{\tau\,\max}=C(Ac_0+C_Q) \quad\cdots\cdots(4)$$

where $Q_{\tau\,max}$ the maximum flow intensity

$$C_Q=\{(-C+C\eta-D\xi)^2+(-D+C\xi+D\eta)^2\},$$
$$C=\frac{a_0d_1}{k_r}+\frac{c_1b_1+a_1d_1}{2(k_a+k_r)}+\frac{c_1b_1-a_1d_1}{2(k_a-k_r)}$$
$$D=\frac{-a_0c_1}{k_r}+\frac{d_1b_1-c_1a_1}{2(k_a+k_r)}+\frac{c_1a_1+d_1b_1}{2(k_a-k_r)},$$
$$\eta=\cos\frac{2\pi}{T_r}T_a,\qquad \xi=\sin\frac{2\pi}{T_r}T_a,\qquad k_a=\frac{2\pi}{T_a},\qquad k_r=\frac{2\pi}{T_r}.$$

Considering the condition $Q_{max}=Q_{\tau\,max}$ the following formula is derived from equation (1) and (4).

$$\frac{\sin k_rx}{k_rx}=\frac{N}{2\pi}\{2(1-\eta)\}^{\frac{1}{2}}\left[\left\{1-\frac{T_aa_1}{A(N^2-1)}\right\}^2+\left\{\frac{T_rb_1}{A(N^2-1)}\right\}^2\right]^{\frac{1}{2}}\quad\cdots\cdots\cdots(5)$$

where $2x$: time interval for the maximum average rainfall intensity

$$N=\frac{T_r}{T_a}$$

Formula (5) gives the value of x the maximum average rainfall intensity (h_x) which should be used in formula

$$Q_{max}=CAhx \qquad \text{(Formula similar to (1))}$$

in order to calculate the maximum flow intensity.

128. Properties of high-density plywood. Shinji HIRAI and Hiroyuki ISHIHARA (Trans. 63rd meeting, Jap. Forestry Soc. 320-321, 1954)

The relations between the preparing conditions and properties of 3-ply high-density plywood were studied. In these experiments, beech (*Faguce crenata* BLUME) rotary-veneers and phenol-formalin resin solution in methanol were used.

1. The tensile strength increases with the increasing of the pressing time, but the adhesive strength does not.
2. The specific gravity and the tensile strength increase with the increasing of the preparing pressure, but the adhesive strength is inclined to increase slightly.
3. It is obvious that increasing of the water adsorption with increasing of the thickness of veneers is due to the influence of the resin content.

129. One method of testing glue joints of the multi-layer plywood. Yoshiyasu YAMAGISHI (Trans. 63rd meeting, Jap. Forestry Soc., 318-320, 1954)

In this experiment, one method of testing glue joints of the multi-layer plywood that is different from the standard plywood shear test has been studied. The test pieces were taken from the five-layer plywoods (beech) and the direct tension in normal direction was applied to the glue joint. (Fig. 1, Fig. 2.)

Thus the adhesive strength of joints and the rupture in veneer strips have been examined, and the results obtained are as follows:

1. If a suitable shape is adopted, the test pieces of this type shall be able to have nearly equal values of adhesive strength as those of the standard plywood shear test.
2. In this method, the direction of the grain of the core veneer strips and that

of saw-slotting should not be same.

3. When the saw-slotting is considerably deep, the test pieces are under the influences of bending moment. Therefore, it is necessary to take care of the depth of saw-slotting.

4. The most suitable dimension of the test pieces is 4.2 × 4.5 cm and the suitable depth of slotting is through two veneer strips.

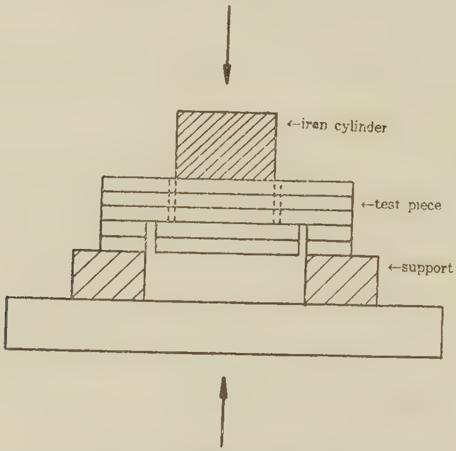


Fig. 1. Test Apparatus

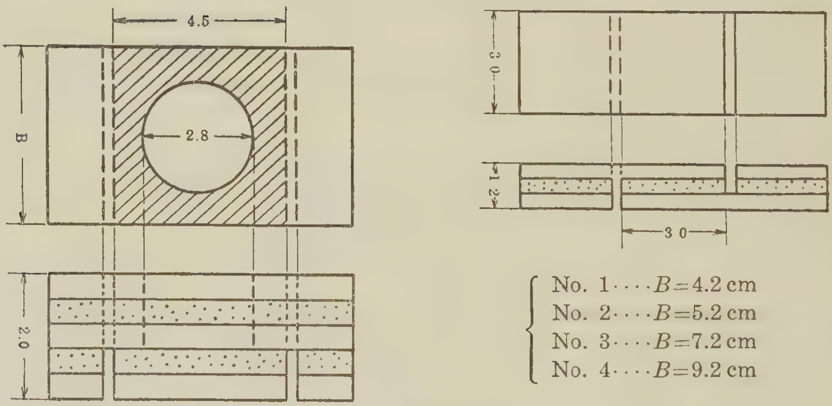


Fig. 2. Test Pieces (cm)

130. Experiment on the flattening process of bamboo (*Phyllostachys pubescens* MAGEL). Shinji HIRAI, Yasushi SUZUKI and Yoshifumi HONMA (Trans. 63rd meeting, Jap. Forestry Soc., 305-306, 1954)

The flattening process was studied on the quartered culm wall of bamboo. Test pieces are 8 cm long in fiber direction, 1.0∼1.2 cm in thickness (or radial) direction, 7 cm in width direction and has the curvature of about 6 cm in center line. Cuticular layer or hard innermost layer was not removed from any test piece. They were

immersed in water or softening reagent several ten minutes and set in the flattening apparatus by which radial and lateral loads can be applied on the piece simultaneously. In this condition, the piece acts as a curved beam the axis of which coincides with the circumference of the bamboo culm. Time schedule of load applying was such that the piece was flattened as quick as possible without tension failure.

Test results show that in ordinary temperature 5～10 minutes are necessary to flatten the bamboo piece which has both cuticular and pith-side layers. Although the softening treatment before flattening is effective to lower the resistant force of bamboo, it seems needful in practical case to remove the above hard layers by any suitable method and maintain the temperature of the piece relatively high during the loading period for the time reduction and prevention of springback of curvature after taking out.

131. A study on the compression of wood. Kakuichi KITAHARA, Jisuke KABURAGI and Masao MURAKI (Bull. Tokyo Univ. Forests **47**, 1-60, 1954)

In this experiment, the authors studied on the compression of wood in air dry, 12～15% moisture content wood, chiefly of Sugi (*Chryptomeria joponica* D. DON.) by a mechanical method with the strainmeter, anatomy and X-ray. But they intended to study its essential qualities qualitatively, and not quantitatively, by averaging their experimental data. According to the results obtained, there is a point of inflexion in stress-strain diagram at initial load which is gained by continuous increasing of load as an ordinary compressive testing method. The diagram for a larger load is nearly straight and for larger load it begins to curve, for the ratio of strain per stress becomes larger. They explain this phenomenon as follows: Crinklings appear in springwood tracheid of Sugi, parallel of micell evidently decreases and orientation angle increases in X-ray photographs, even though with very small stress, for instance 10 kg/cm^2. When the load increases, the parallel and orientation angle of micell increase much more with about one half of the compressive strength, 166 kg/cm^2. On the other hand, slip lines (or slip planes) appear in summerwood tracheid of Sugi and the parallel of micell does not change, but the orientation angle slightly changes even though with small initial stress. And the properties of springwood and summerwood are changed by small initial stress with changes in the amorphous part or more macrostructure of wood. Consequently, the property of wood differs from that of virgin wood and a point of inflexion appears in stress-strain diagram. Further results of mechanical tests concerning to the total strain by loading and the residual strain after removal of load can also be explained from the change in microstructure of wood by mechanical processes above mentioned.

132. Studies on weight-growth of forest trees. V. *Pinus strobus* LINNAEUS of the Tokyo University Forest in Hokkaidô. Shinji HIRAI (Bull. Tokyo Univ. Forests **48**, 221-235, 1955)

Five sample trees of *Pinus strobus* L. of 39 years of age were taken from an artificial stand in the Tokyo University Forest in Hokkaidô. The distribution of the bulk density of wood (calculation based on weight in oven dry, and volume in green) within the stem of each sample was examined, and from this result the weight increments of individuals and the weight produce of the stand were calculated.

The following results were obtained.

(1) There are left- and right-inclined types in individual frequency curves of the bulk density of wood. The degree of deviation is smaller than those of any previously reported species, i. e. *Larix leptolepis, Picea excelsa* and *Cryptomeria japonica.* The total frequency curve is left-inclined and is distinguished with prominent mode and narrow distribution width.

(2) The distribution maps of bulk density of wood vary nidividually to some extent, but the following general tendencies are found. The wood is generally heavy through the center of tree. As to the vertical change, the wood is heavy at the tree base, soon becomes lighter in the broad middle part and turns heavy towards the tree top. The outer-most part of the base has somewhat heavier wood than the adjoining inner parts.

(3) There is no correlation of 1st degree between the ring-width and the bulk density of wood.

(4) All sample trees have not yet attained to the year of the maximum current annual increment of volume and also of weight. The weight-increments of the samples are mostly affected by their volume ones. The increment percent is higher in volume than in weight in the early stage, but it turns contrary afterwards. The turning period attains earlier with dominant trees.

(5) The standard bulk density of the individuals, which are obtained by dividing the total weight-increment by the volume one, are 270-317 kg/m^3, and the mean is 291 kg/m^3. There is a tendency that the more inferior the tree is, the heavier the wood is.

(6) The total produce per 1 ha of this researched stand amounts to 109,695 kg in weight and 376.91 m^3 in volume. The average annual produce is 2,812 kg in weight and 9.66 m^3 in volume.

133. The scratching resistance of wood on a razor knife. Shitomo MAMADA (Wood Industry **10**, 113-115, 1954)

The scratching resistances of a wood surface, which were measured by an experimental equipment with a razor knife, were studied on many species of wood.

The scratching resistances which were affected by weighting on this equipment and by pulling razor knife on the test pieces at the speed of 1 cm/sec, were measured by a spring balance.

The relationships between scratching resistance and specific gravity of wood, and hardness when the knife is pulled perpendicular and parallel to grain were obtained.

By the results of this experiment, it was known that the scratching resistance was inclined to show a gradual diminution with increasing of specific gravity and hardness of wood. Roughly speaking these relations were shown more clearly in a test when drawing perpendicular rather than parallel to the grain, that is, the former gives −0.82 as regards specific gravity and −0.85 as regards hardness, the latter gives −0.67 and −0.51 respectively for coefficient of correlation.

As regards moisture content of wood, using "HINOKI" (*Chamaecyparis obtusa*), the scratching resistance showed a tendency to increase with increasing moisture content.

134. Distribution of bulk density of wood within th estem of *Pinus strobus* LINNAEUS in Hokkaido, and its weight growth. Shinji HIRAI (Trans. 63rd Meeting, Jap. Forestry Soc., 261-263, 1954)

Five sample trees of *Pinus strobus* LINNAEUS of 39 years of age were taken from an artificial stand in the Tokyo University Forest in Hokkaido. The distribution of the bulk density of wood (weight in oven dry/volume in green) within the stem of each sample was measured, and from this result the weight increment of individuals and the weight produce of the stand was calculated.

135. Studies on the head pressure process (so-called BOUCHERIE process) for wood poles preservation by water borne preservatives. (1) On sodium pentachlorophenolate. Takeo SHIBAMOTO and Ryuji SHOJI (Bull. Tokyo Univ. Forests **10**, 31-38, 1955)

Sodium pentachlorophenolate (Na–PCP) will be used as the preservative for wood poles in the BOUCHERIE process.

(1) Na–PCP solution: concentration...1.0%, pH...7.5∼90.

(2) Volume of solution: 600∼900 liters per cubic meter of Wood.

If the height of the head pressure is the same as the length of the pole, the treatment time is necessary for $L \times 1.5$ days, and L is the length of the pole represented in meters.

136. Studies on the head pressure process (so-called BOUCHERIE process) for wood poles preservation by water borne preservatives. (2) On the F. D group preservative. Takeo SHIBAMOTO and Ryuji SHOJI (Bull. Tokyo Univ. Forests **10**, 39-47, 1955)

Penetration velocity of the F·D group preservative (NaF and Na-dinitrocresolate or Na-dinitrophenolate mixture) is very fast, and it distributed itself into the wood tissue in the same manner as $CuSO_4$.

Practical treatment conditions are summarized as follows.

(1) F.D solution: concentration...1.0%, pH...<7.0.

(2) Volume of solution: 600∼900 liters per cubic meter of wood.

If the height of the head pressure is the same as the length of the pole, the treatment time is necessary for $L \times 0.5\sim1.0$ days, and L is the length of the pole represented in meters.

137. Studies on some properties of the stem and shoot of bamboo (*Phyllostachys edulis* RIV.). (No. 2) Variations on chemical constituents through growth. Takeo SHIBAMOTO, Ryuji SHOJI and Sumiko KUBOTA (Bull. Tokyo Univ. Forests **48**, 203-207, 1955)

(1) In the bamboo shoots, the chemical constituents fundamentally vary by 7∼10 days after sprouting out of soil, and except for the nitrogen content, the constituents of the samples by 20 days after sprouting out of soil approximately resemble those of a bamboo stem.

(2) In the bamboo stems, harvested in February and June, the content of water soluble matters is higher than that of the samples harvested in September, but a 2% HCl soluble matters is in opposite relation to the content of the former.

138. Studies on some properties of the stem and shoot of bamboo (*Phyllostachys edulis* Riv.). (No. 3) On nitrogenous matters in the shoot of bamboo. Takeo SHIBAMOTO, Ryuji SHOJI and Koichi TAGAWA (Bull. Tokyo Univ. Forests **48**, 209-219, 1955)

The amino acids were detected by paper chromatography, and nitrogen content was determined by the KJELDAHL and van SLYK method.

(1) In each samples, 9～12 kinds of amino acids are detected at free condition. Proline occurs in samples during the younger stage of growth before 5 days, and threonine occurs after 5 days, both being calculated after sprouting out of the soil.

(2) In the fresh samples, the total nitrogen content are higher than those of the dried samples.

(3) Total nitrogen, amino-nitrogen, amid-nitrogen and protein-nitrogen show high content in the samples during the younger stage of growth and also at the top part of the stem.

(4) In many cases, the content ratio of amino-nitrogen and protein-nitrogen against total nitrogen show the opposite relation to each other.

139. Studies on some properties of the stem and shoot of bamboo (*Phyllostachys edulis* Riv.). Especially on properties relating to water. Takeo SHIBAMOTO and Yoshiyuki INOUE (Bull. Tokyo Univ. Forests **47**, 189-200, 1954)

(1) By combining an optical lever with a chemical balance, a new weighing apparatus was deviced. With this it is able to weigh a substance which changes continuously as the time passes.

(2) Hydroscopicity of bamboo stem are as follows; greater at inner part than at outer part, great at the parts from the 7th to the 12th knot, great in bamboo-shoot harvested on the 7th day after sprouting out from the surface of the soil and great in the stem of bamboo cut down in June. In all cases, the values become smaller by extracting the samples with hot water.

(3) In general, the growth of molds on bamboo stem is so rapid and is a proportion to its hygroscopicity.

(4) At the 7% moisture content of bamboo stem, both the evaporating velocity and hygroscopic velocity show a sudden enormous change, and this moisture content coincide with the case of inclination for a changing point of the dielectric constant. It is, therefore, presumable that this moisture content shows a critical point, to distinguish combined water from free water in bamboo stem. But in the case of bamboo-shoot, this changing point is not clear. It may be supposed that the cause is due to the fact that bamboo-shoot contains more amorphous portions and hydrophylic radicals than mature stems.

(5) Hygroscopicities of some organic substances were examined, and it revealed the existence of the following in orderly arrangement,

peptone > sucrose > glucose > cellulose

and the evaporating velocity of a solution containing each of these substances also follow all the same in the above mentioned order.

(6) It is also presumed that the affinity between bamboo stem and preservatives can arrangeable in the following order,

DNC-B > Na-PCP-B > $CuSO_4$-B

And the affinity between bamboo stem treated with the preservatives and water as follows:

$$(CuSO_4\text{–}B):W > (DNC\text{–}B):W > (Na\text{–}PCP\text{–}B):W .$$

In the above two formula, *B*: Bamboo, *W*: Water, DNC–B, Na–PCP–B and $CuSO_4$–B show each bamboo stem treated with DNC (Dinitrocresole), Na–PCP and $CuSO_4$ solution respectively.

140. Studies on preservative treatment of the stem of bamboo (*Phyllostachys edulis* Riv.). Takeo SHIBAMOTO and Yoshiyuki INOUE (Bull. Tokyo Univ. Forests **10**, 23-30, 1955)

(1) The inhibiting effects of sodium penta- and tetra-chlorophenolate on the molds on an agar-medium are greater than the other preservatives.

(2) Absorption rate of 2% Na–PCP solution at three sections of a bamboo stem are the following;

cross : radial : tangential = 25 : 5 : 1

Amount of absorbed solution was the greatest in the test piece treated under pressure process.

(3) Penetration of Na–PCP in bamboo stem was less than that of NaF or Na–DNP.

(4) In the hot-and-cold-bath process which was one of the 4 kinds of treating methods examined, penetrating rate was greater. Moreover, the penetration seemed to become better in the case of bamboo stem cut down in summer.

(5) DNC and DNP were more poisonous against *Irpex lacteus* FR. and Penicillium sp. on bamboo stem pieces. In our experiment, Na–PCP. Cu–PCP. HgCl and $CuSO_4$ were less effective against molds, though they are strongly poisonous for wood rotting fungi.

(6) The effects of inorganic preservatives on molds were not observed. The relative preserving effect of some chlorophenolates were as follows;

Sodium pentachlorophenolate > Sodium tetrachlorophenolate > Sodium trichlorophenolate.

141. On a new simple type thermistor and its application for measuring soil temperature. Takeo SHIBAMOTO and Yoshiyuki INOUE (Journ. Jap. Forest. Soc. **36**, 247-249, 1954)

(1) Authors studies of a new type of thermistor made by the alloy electrodeposition method.

(2) A soil thermometer set up of this type thermistor was deviced and temperature of some soils were measured with it.

(3) Considerable influences of soil coverings with seaside plants or litters on the surface soil temperatures were observed.

142. Studies on carbonization of wood. XIV. On the difference of yield of acetic acid in the thermal decomposition of wood among the kinds of tree. (2). Kyoji MINAMI and Kimie KAWAMURA (Journ. Jap. Forestry Soc. **37**, 75-78, 1955)

In the preceeding paper it was presumed that the difference of the content of acetyl groups extractable with 1% NaOH at room temperature in woods may bring about the diversity of the yield of acetic acid among the kinds of tree in wood distil-

lation. Now, choosing at random five kinds of trees, *Shiia Sieboldii, Cornus controversa, Quercus serrata, Rhus silvestris,* and *Pinus densiflora,* it was examined whether the above mentioned presumption should as well be reasoned in their wood distillation or not.

Also, as the preceeding paper showed, in the case of the residues of wood extracted with 1% NaOH, the results and the course of their thermal decomposition resembled each other among the kinds of tree, and the amount of acetic acid in the extract of wood with 1% NaOH was found to be almost corresponding to the difference of yield of distilled acetic acid between an intact wood and its residue extracted with 1% NaOH for any kind of tree. Thus, these facts obviously support the presented supposition.

Further, the contents of cellulose, lignin, pentosan and acetyl group in the residues extracted with 1% NaOH were determined. The contents of pentosan in the extracted residues were remarkably different between coniferous trees and broad-leaved trees, but, in their dry distillation, almost equal amounts of distilled acetic acid were found. These mean that pentosan is not a powerful source for distilled acetic acid in wood distillation.

143. On the lignin isolated with aqueous xylenesulfonate solution. Nobuhiko MIGITA, Junzo NAKANO and Yoshikazu ITO (Journ. Jap. Forestry Soc. **36**, 343, 1954)

Some experiments were carried out on the beech and spruce lignin isolated with aqueous xylenesulfonate solution, designated "hydrotropic lignin". The lignin thus obtained has been considered by some investigators to be one of the lignin preparations whose properties resemble that of protolignin. The results of the authors' experiment, however, show that there is a marked difference between them. The results may be summarized follows.

(1) Solubilities in several solvents of the isolated lignins were fairly well and were similar to those of alkali lignin and phenol lignin. But in the phloroglucinol-hydrochloric acid reaction, the beech lignin was negative and the spruce lignin was faintly positive. In the Mäule reaction the beech lignin was negative, too.

(2) The methoxyl content of the beech lignin was 16.2~16.9% and that of the spruce lignin was 10.8~12.0%. This indicates that some of methoxyl groups existing in the original lignin were splitted in the isolating process. The methoxyl content of fully methylated lignins, which were prepared by methylation of the isolated lignins with diazomethane and then by methylation of the resulting products with dimethylsulphate and sodium hydroxide, were 26.6% in the case of beech and 20.8% in spruce. These figures indicate that some of free hydroxyl groups in lignin were blocked up during the isolation, due to selfcondensation between lignins and condensation between lignin and degraded products from the carbohydrates.

(3) The dissolution of lignin with xylenesulfonate cooking may take place in two steps. In the first step the lignin is changed by the action of hot water in high temperature, and in the second step the lignin so altered is dissolved in the xylenesulfonate reagent.

144. On the mechanism of color reaction of lignin (IV). Cross-Bevan color reaction of hardwood lignin. Nobuhiko MIGITA, Junzo NAKANO, Tatsumi OKADA, Gorō ŌASHI and Masao NOGUCHI (Journ. Jap. Forestry Soc. **37**, 26, 1955).

The authors (MIGITA and NAKANO) have reported on the mechanism of the CROSS-BEVAN (Cl_2-Na_2SO_3) color reaction (Bull. Tokyo Univ. Forests. **43**, 139, 1952). In order to obtain additional information, twelve chloro-derivatives of trioxybenzene (related to hardwood lignin) and three chloro-derivatives of dioxybenzene (related to softwood lignin) were synthesized, and examined whether or not these compounds give the characteristic color with sodium sulphite treatment. From the results, the following conclusions were drawn out on the mechanism of the CROSS-BEVAN color reaction. Namely, the group responsible for the color reaction is syringyl nucleus situated at the terminal of lignin molecule. Moreover, if the lignin is positive in the color reaction, lignin must satisfy the following requirements: (1) Carbonyl group must exist in α-position of side chain of the terminal. (2) Hydrogen atoms in 2- and 6-positions of syringyl nucleus must be substituted by chlorine atoms. (3) Two methoxyl groups in syringyl nucleus must be splitted off by the chlorine treatment, and consequently free phenolic hydroxyl groups are produced.

In order to confirm the above conclusions, the following experiments were carried out. (1) After chlorination the model compounds containing methoxyl groups attached to benzene nucleus were treated with ferric chloride, and then the colors appeared were observed. The results indicate that methoxyl groups were split off by chlorination, and that trioxyphenol compounds were probably produced from trimethylgallic acid and syringic acid. (2) The absorption spectra in visible region of the model compounds, treated with chlorine and then sodium sulphite, were compared with those of beech wood meal, alkali lignin and methanol lignin treated in the same way. The absorption curves of the formers were maximum at $515 \sim 535$ mμ and minimum at $400 \sim 445$ mμ, and those of the latters were maximum at $520 \sim 545$ mμ and minimum at $430 \sim 450$ mμ. This inconformity was probably caused by a variety of resulting products after chlorination. The result, therefore does not deny the conclusions given above.

The effects of chlorine treatment in the CROSS-BEVAN color reaction are considered as follows. Firstly the introduction of chlorine atoms into benzene nucleus causes methoxyl groups to be split off, and produces the compound with free hydroyxl groups. Secondly the combined chlorine atoms make hydrogen atoms, in hydroxyl groups of resulting product, active by an inductive effect. With the intention of confirming this assumption, trioxybenzene derivatives containing nitro groups, which belong to the same electron attracting groups as chlorine, were prepared and subjected to sodium sulphite treatment. In this experiment the positive color reaction was recognized on dinitrogallic acid ethylester. This indicates that the above assumption is correct.

A. RUSSEL had reported that poly-8-methoxy-dihydrobenzopyrone, designated as the synthetic lignin by him, gave the positive color reaction in the CROSS-BEVAN treatment. This does not agree with our opinion described at the top. So the compound was synthesized and subjected to the CROSS-BEVAN reaction. As it was expected, no characteristic color can be observed on the compound.

145. The effects of chlorination and hot alkali treatment on wood cellulose. Nobuhiko MIGITA, Junzo NAKANO, Shigeaki MAKI and Yuichiro SUMI (Journ. Jap. Wood Research Soc. **1**, 27, 1955)

In order to ascertain the effects of chlorination and hot alkali treatment on wood cellulose, purified sulfite pulp, which had been prepared from unbleached pulp of cuprammonium viscosity 4.6 by sodium chlorite and then 10% solution of sodium hydroxide treatment in nitrogen stream, was submitted to chlorination or hot alkali extraction, and the qualities of the resulting pulps were examined.

The results may be summarized as follows:

(1) α-cellulose content of pulp is lowered by chlorination, because the rate of dissolution of low molecular substances is less than the rate of degradation of the α-cellucose.

(2) The presence of oxygen acclerates the degradation of α-cellulose in hot alkali treatment, but concurrently accelerates the dissolution of β- and γ-cellulose in hot alkali, too.

(3) The degradation of α-cellulose is somewhat drastic in the case of hot alkali treatment after chlorination as compared with that in hot alkali treatment only, because the reducing groups produced in the wood cellulose by the chlorine treatment, help the formation of carboxyl groups in the following hot alkali treatments.

146. The essential oils from the wood of incense cedar (1). On phenolic substances. Tomoichiro NAKATSUKA and Yoshiyuki HIROSE (Journ. Jap. Forestry Soc. **36**, 280-283, 1954)

The phenolic portion of the essential oils from the wood of incense cedar (*Libocedrus decurrens Torr.*) was examined. It is composed of two main constituents, carvacrol and an unknown phenol. It is probable that this unknown phenol has one of the alternative structures, 2-hydroxy-5-methoxy-1-methyl-4-isopropylbenzene or 5-hydroxy-2-methoxy-1-methyl-4-isopropylbenzene.

147. Occurrence of nootkatin and hinokitol in the wood of *Juniperus chinensis L.* Tomoichiro NAKATSUKA and Yoshiyuki HIROSE (Journ. Jap. Forestry Soc. **37**, 196-197, 1955)

It has been found that nootkatin and β-thujaplicin are contained in the essential oils from the wood of "Byakushin" (*Juniperus chinensis L.*).

VII. Zootechnical and Veterinary Science

Abstracts Nos. 148—185

148. A local method of prolactin assay by the comparison of the responses in the two crop-sacs of the same pigeon. Yuichi TANABE, Yoichi SHODA and Yuichi SAEKI (Bulletin of the Institute of Agricultural Sciences, Series G [Animal Husbandry]. **9**, 57, 1954)

To find a more objective criterion for the estimation of the degree of stimulation in a local method of prolactin assay by the comparison of the responses in the two crop-sacs of the same pigeon the present study was performed.

Using various dosages of Squibb prolactin, a regression equation, between the ratio, of the dosages used in the range from 0.0225 I.U. to 0.225 I.U. (X) and the ratio between two response areas (Y) was obtained as $Y=0.991\,X^{0.498}$, which closely approximated to $Y=\sqrt{X}$.

In a test in which the fowl's pituitary suspension was divided into two, it was shown that this assay method proved well applicable.

By injecting the standard preparation, potency of the unknown preparation can be obtained using this exaction. In this can the error in less than 30%.

It is to be noticed that this assay can be carried out on pigeons which have varied sensitivity for prolactin stimulation.

149. The relation between dairy performance and the changes of mammary glands and its stimulators. I. The relation between milk production and the mammary structure in goats at the second lactation. Motoo NAITO, Yoichi SHODA and Jiro NAGAI (Jap. Journ. Zootech. Sci. **25** [2-4], 142-150, 1954)

As a first step towards the investigation on the mechanism of exhibition of dairy performance, the structural changes of mammary tissues of three lactating goats with different performances were studied on five stages. Results obtained are briefly summarized as follows.

(1) As there was no significant difference in the tendency of decrease of the daily production after the maximum period amongst these three goats, the peak production and duration of lactation, especially the former had a great influence upon the total production.

(2) In the mammary tissue such characters as number of alveolus per lobulus, sectional area of alveolus and the number of glandular cells per section of alveolus decreased with the advance of lactation. Whereas the number of alveolus per sight field and the height of glandular cells increased, the coefficients of sectional area of alveolus decreased a little. Nevertheless, the tendency of decrease of sectional area of alveolus was similar to that of milk production.

(3) Such characters as the sectional area of alveolus, the number of glandular cells per section of alveolus and the number of alveolus per lobulus may be the important characteristics of the mammary tissue in relation to milk production. And

further, it seems necessary for the exhibition of high production that these characters be as large as possible, and should decrease very slowly after the maximum period. Accordingly, it may be important in the selection of dairy animals to judge precisely on the several stages of the lactation of the mammary gland quantity and the quantity as the response of the gland to the stimulators.

150. Interrelation between the areas of the mammary glands of mice treated with estrogen in four estimating methods. Jiro NAGAI (Jap. Journ. Zootech. Sci. **25**, Suppl. **2**, 13, 1954)

The present study was undertaken in order to obtain the estimating method of mammary gland area of mice by a simple but accurate procedure. Gonad-ectomized 35-day old mice were treated with constant doses of estrogen. The third thoracical mammary gland was enlarged on the section paper by ten times in length and end points of mammary duct were connected with lines subjectively according to the rule. Estimating methods were in four ways: (A) Index of mammary duct area method (I.M.D.A. method) which is a considerably accurate one but takes times and labor, (B) Planimeter method which is simple but does not give an account for density of mammary development, (C) Length of long axis times length of vertical line which divides long axis into two equal parts, (D) Length of long axis times mean of three vertical length which divides long axis into four parts. The latter two methods were more simple ones but offered rough estimates. Mammary preparations used were 63, 47, 40, and 27 sheets in female, castrated female, male, and castrated male mice respectively.

If the estimate by I.M.D.A. method was one unit, then the confidence of limit of mean of the estimates by B, C, and D method were as follows: female, 1.74-1.86 2.21-2.49 2.06-2.24 castrated female, 1.62-1.76 2.18-2.52- 1.95-2.19 male, 1.65-1.85 2.16-2.50 1.88-2.24 castrated male, 1.72-2.02 2.33-2.89 2.13-2.35. Respectively the planimeter method was most reliable among the estimates by B, C, and D methods the estimates by A and B method was compared.

Results obtained are as follows:

(1) Confidence limits of mean by A and B methods were 17.3-21.7 30.3-39.1 in female, 20.0-25.0 32.7-42.9 in castrated female, 13.5-17.9 23.5-33.3 in male, 14.6-19.0 26.1-36.1 in castrated male respectively.

(2) Correlation coefficients were 0.85 in female, 0.95 in castrated female, 0.94 in male and 0.77 in castrated male.

(3) Interrelation between the estimates by both methods was represented in such formulae as $B = 1.74A + 0.9$ in female, $B = 1.70A - 0.5$ in castrated female, $B = 2.08A - 4.3$ in mole, $B = 1.72A - 2.2$ in castrated male respectively.

151. Influences of hypophysectomy in mouse. I. Effects upon testis, ventral prostate, seminal vesicle and adrenal of adult mouse. Shiichi NISHIDA and Koshi MOCHIZUKI (Jap. Journ. Zootech. Sci. **25** [2-4], 71-78, 1954)

Twenty adult male albino mice were hypophysectomized, and sacrificed at various periods after this operation and ten normal litter mates were used as the controls. Animals used in this study were bc-strain mice and they were two to five months old at the operation time. Tissues were weighed and fixed by BOUIN's and

Zenker-formol fluid, and stained with hematoxylin-eosin, HEIDENHAIN's iron hematoxylin (in testis) and by a modification of ZINSSER's (1951) Ponceau-fuchsin mothod (in adrenal). The results obtained were as follows.

(1) Macroscopic observations:

As time went by after hypophysectomy, all the organs studied underwent a significant regression in both their size and weight, and faded from their normal color, though testes became brownish yellow. Testes and adrenals became very flabby.

(2) Histological observations:

Testis: The diameters of seminiferous tubules decreased rapidly by the twentieth day after hypophysectomy. After this period the decreasing rate became very slow. There were many spermatozoa in the tubules until the tenth day or so after operation, but after the fifteenth day only a few were found in several tubules, and disappeared completely on the twenty-fifth day. Spermatids and II-spermatocytes also disappeared on the twenty-fifth day or so after operation, and germinal epithelia became thinner. Only spermatogonia and I-spermatocytes were observed in the tubules, but their mitotic figures were seen even on the fortieth day or so aftr hypophysectomy. The degenerative changes of the interstitial cells, such as pycnosis and karyorrhexis, were observed in the testes on the fifth day after hypophysectomy, and cell boundary became obscure, so the cells were stained black strongly in a mass by HEIDENHEIN's iron hematoxyline.

Adrenal: Even on the fifth day after hypophysectomy the cells of *Zona fasciculata* atrophied and their lipid decreased in amounts, especially in the inner fasciculate zone, and as the days passed these cranges became rore prominent, and reached to the maximum on about the thirtieth day after operation. The cells of *Zona glomerulosa* were observed to become hypertrophic, but such changes were rather slight. The remnant cells of X-zone were observed seldom. They were scattered near the corticomedullar boundary membrane. This structure is very similar to that of the normal adult male. No significant change was observed in the medulla.

Accessory reproductive organs: Though the epithelial cells of the ventral prostate and the seminal vesicle were typical columner cells in normal adult controls, in experimetns the epithelial cells of the ventral prostate became flattened and the "light area" in their cytoplasma disappeared completely by the tenth day after hypophysectomy. At that period the height of the epithelial cells of the seminal vesicle was reduced to less than one-half of the normal height and "halo-like area" disappeared from their cytoplasma, but very few secretion granula were found in the cytoplasma between the nucleus and free margin of the cells. These figures were also observed even on the fortieth day after operation.

152. The prenatal histogenesis of the lymph node in the domestic duck (*Anas plathyrhynchos domestica* L.) Shigehiro MORITA and Shiichi NISHIDA (Jap. Journ. Zootech. Sci. **25** [2-4], 79-82, 1954)

In our previous report, we observed the post-natal histogenesis of the lymph node in the domestic duck (*Anas plathyrhynchos domestica* L.). In this paper the prenatal histogenesis of the same animal is reported. The materials (lumbar lymph nodes of ducks from the 13th day of embryo to the time immediately after hatching) were fixed in Bouin's nd Helly's fluid and stained with LILLIE's (1951) allochrome

stain for connective tissues.

(1) After fifteen days of incubation, it was observed that the primordial process of the lymph node pretruded from the wall into the lumen of the lymph vessel. And this primordium of the lymph node which was covered with endothelial cells, was infiltrated with dark stained round cells and contained lattice fibers.

(2) After eighteen days of incubation, the process of this primordium observed on the 15th day of the embryo, developed into cords and bridged over the lumen. At the same time, the lymph vessel branched out some small lymph vessels, and the mesenchym lying between the branches of the lymph vessels was infiltrated with dark staining round cells. This also developed into lymph node. Peripheral zone was not observed.

(3) After twenty-two days of incubation, the above-mentioned lymph cords developed well and increased in their numbers and length, and showed reticular structure. Peripheral zone appeared at this period.

(4) At the time of hatching, the lymph reticular cords were more complex than that after twenty-two days of incubation. Lymph follicle first appeared at this period. In our previous report, we observed the thin collagen fiber band enclosing the lymph node in five days old duckling, but in this study we did not observe the thin collagen fiber band in the domestic duck.

153. A technic for hypophysectomy of the mouse. Koshi MOCHIZUKI (Jap. Journ. Zootech. Sci. **25** [2-4], 99-101, 1954)

Up to this time hypophysectomy in the mouse seems to have been considered as almost impracticable in our country, but the increasing demand for the experimental use of hypophysectomized mice in studies of pituitary gland and its relations to other endocrine glands has made it desirable to develop a reliable easy and rapid operative technic for these animals.

The only descriptions of the operative technics on mice that I could find are discussed in only two papers, one by Mr. SELYE et al. (1934 and one by Mr. THOMAS (1938), and both of these seem to be somewhat cumbersome and difficult for routine practical use.

Therefore, the procedures of these earlier workers on both the rat and the mouse were tried and certain features of their methods adopted and some new instruments used, so that the operation may accommodate itself more easily to routine practical use.

The procedures and instruments which serve best in our hand after much experience are here described and illustrated in detail.

The technic described here presents the advantages of simplicity, speed, total exposure of the pituitary and its removal under direct vision the advantage of an operation easily performed both at an earlier age (weighing as little as 6 gram.) and at an older one (weighting over 20 gram.) with low mortality.

154. Possibility of direct transportation of testicular hormone to some target organs located close to the testicle in the postnatal rat and its physiologic significance. Yoshisuke SUZUKI, Yasuo TOSHIMORI and Koshi MOCHIZUKI (Endocrinology **56** [4], 347-358, 1955). (in English)

The paradox, observed in the sexual maturation process in the rat that the epididymal growth, descent of testis and spermiogenesis occur at about 30–40 days of age, much earlier than the significant growth of seminal vesicles and prostates, may be reconciled mostly by a concept in which the testis hormone is transported not only by the systemic blood circulation but also by a direct route to the targets adjacent to the testicle. Therefore between these two kinds of target, one adjacent to the testis and the other remote, there exists a quantitative difference in fixation and utilization of androgen in this early postnatal life.

The results which support this concept are as follows: (1) By the unilateral orchiectomy in immature rats, the growth of a separated epididymis at the testis side predominated over that of the contralateral orchiectomized. (2) The influence of the epididymal content of testicular secretion upon the weight increase of epididymis was not significant before 60 days of age when sperm began to be detected in the tail of intact epididymis. (3) The conditions of inequality of the androgen content or of the androgen production between both testes, provided by the unilateral intra-testicular implantations of androgen pellets or of anterior pituitary materials in immature animals, induced a significant asymmetric growth of the epididymides and the different ducts. By the overdosage of the pituitary and of the androgen, the asymmetry became less significant, due to the weight increase of these organs of non-implanted testis side, and simultaneously the stimulating effect on seminal vesicles became evident. (4) The growth asymmetry caused by unilateral orchiectomy of four days period was followed during the course of sexual maturation. The ratio of asymmetry was found to be the highest at about 30 days of age, before any significant growth of seminal vesicles had occurred. Thereafter this ratio started to decline, though the weight of their seminal vesicles began and continued to increase.

155. An improved technique for the hypophysectomy in dogs and cats by the buccal route. Tomonori IMAMICHI and Teiichi ETO (Jap. Journ. Zootech. Sci. **25**, 83-96, 1954)

The described technique is a modification of McLean's trans-buccal method in carnivora. The operation is performed without assistant service under the barbiturate anesthesia in dogs and by the subcutaneous ether injection in cats.

The adoption of properly devised small instruments can exclude several troubles in the operative procedure. A clod of clay wrapped in a vinyl sheet is used conveniently for the head fixation. Three kinds of steel hooks are used snugly for drawing the tongue, for lateral retraction of the incised edges of soft palate and of the freed edges of the mucoperiosteum of the sphenoid bone. Dental points are available to prevent the bleeding in dipole and to produce easily a clear-cut oval hole withohut injuring sinus carvernosus. Dura is incised carefully after finding a horseshoe form of the sinus. The attachment of the gland to diaphragma sellae is separated by a very small steel plate probe. After the stalk section, with a fine scarpel, the whole gland is removed in one piece. The defect hole is filled with penicilline and is not closed.

The technique will not be difficult even for the beginner, however in some dogs, tedious time may be necessary for the hemostasis during performation of diploe.

156. Comparison of labouring power between horses and cattle. Analysis of walking in draught. I. On the vertical movement in various parts of the body. Toshio OKABE, Yoshio SETO, Takayoshi MIURA, Shin-ichi NOMURA, Hiroshi SAWAZAKI and Hichiro INADA (Jap. Journ. Zootech. Sci. **25**, 174-178, 1954)

(1) We compared the vertical movement of the body of horses and cattle, drafting the sleigh weighted 200 Kg, with the unstrained walk, by means of a serial photography and a cyclegram.

(2) The body-axis of horse, which moves like a both-end-supported-beam in the unstrained walk, shows a modified feature by sliding the phase between the head and back. The movement of the head and neck increases, and that of the hind parts, on the contrary, decreases considerably. The alteration of walking manner, especially stretching, weighting and stepping, become more distinct, and the difference of the elasticity of walking between horses and cattle is redoubled.

(3) When animals draft some load they always hold a certain working posture and maintain it during the work. The movement of the fore-hand is strengthened and that of the hind continues to show a monotonous transition on the locus in photography. We can presume through these features of movement that the locomotion of the body weight has been facilitated by mighty movement of the fore-hand, and the hind limbs work mainly for drafting of the load.

157. Comparison of labouring power between horses and cattle. Analysis of walking in draught. II. On the alteration of joint-angles. Toshio OKABE, Yoshio SETO, Takayoshi MIURA, Shin-ichi NOMURA, Hiroshi SAWAZAKI and Hichiro INADA (Jap. Journ. Zootech. Sci. **25**, 179-184, 1954)

(1) The process of alteration of the joint-angle, during the time when the horses and cattle draft the sleigh weighted 200 Kg, has been traced on a serial photography, and compared with that of the unstrained walk.

(2) The movement of the body-axis remains without variation from the unstrained walk, but the alteration of inclination-angles of head and neck is exaggerated and that of the hip is diminished, because of holding a working posture. It seems that the walking manner in both horses and cattle is by far hardened, because the stretching and flexing of the joints of extremities is simultaneous with the period of stepping.

(3) Drafting of the load limits the movement of the upper parts of the body, and forces the fore limb to step high, and the period during which the hind limb strides foreward is shortened.

158. Comparison of labouring power between horses and cattle. Correlation among the stride length, time required and loading weight. Toshio OKABE, Yoshio SETO, Takayoshi MIURA, Shin-ichi NOMURA, Hiroshi SAWAZAKI and Hichiro INADA (Jap. Journ. Zootech. Sci. **25**, 185-188, 1954)

(1) The distance passed through and time required for 10 strides were measured on every stage, drafting the load, which has been increased in advance by 45 Kg, and the correlation among the load, the stride-length and the time required was discussed.

(2) That the stride-length, decreases successively with the increasing load,

has been proved in common with the horses and cattle. We can recognize a linear relation between them.

(3) Moreover, it was recognized that the cattle accelerate the pitch of walk, and there is a linear relationship between the stride-length and the pitch. But we could find no correlation between them in horses.

159. On the undulation of respiration when the abdominal movements are inhibited. Toshio OKABE, Hiroshi SAWAZAKI and Hichiro INADA (Jap. Journ. Vet. Sci. **16**, 141-146, 1954)

We have made continuous observations on the pneumotachogram of the rabbit when the N. phrenicus and the abdominal muscles (M. rect. abd., M. obliq. abd. and M. trans. abd.) are cut. Recording apparatus and analytical methods are the same as in the previous report.

The results are as follows:

(A) N. phrenicus Cut.

a) Undulation of the time interval disappeared, but that of the amplitude and the volume were remarkable.

b) The compensation for the time interval by the amplitude was not presented.

(B) Abdominal muscles Cut.

a) Undulation of the time interval and the amplitude are approximately the same in each individual, and so is the resting respiration.

b) The compensation of T-A is recovered, and the variance of the volume is smaller.

From these results, we presumed as follows:

(1) The respiration can be regulated by the breast movement alone.

(2) Abdominal muscles cannot take part in the respiratory movement without the co-operation of the diaphragm.

(3) The regulation of the abdominal muscles and the breast movements are independent of each other.

(4) Undulation of respiration does not arise through the reciprocal relation between the movements of breast, diaphragm and abdominal muscles. But it is probable that the nervous impulse undulates, regularly.

(5) If the time interval is related to the duration, that the nervous impulse has discharged, and the amplitude related to the density; we think, both of them undulate regularly, but the latter depends upon the working-level of the effector.

160. On the form of the pneumatachogram under normal conditions when the N. phrenicus or the abdominal muscles were cut. Toshio OKABE, Hiroshi SAWAZAKI and Hichiro INADA (Jap. Journ. Vet. Sci. **16**, 147-157, 1954)

The pneumotachogram of the rabbit were delineated, under normal conditions, with the N. phrenicus, or abdominal muscles, being cut. We extended each form in FOURIER's progression, and extracted their characteristics, objectively. And this has led us to discuss the actions of the diaphragm, abdominal muscles and the thorax, and how they associate with each other.

(1) The form under the normal condition is the sine-curve-like smooth process, and in general is expressed by the fundamental wave and the second harmonics

in FOURIER's progression.

(2) When the N. phrenicus is cut, the inspiration is more flat, and the special point of inflexion is presented in the middle of expiration. Their forms are expressed approximately with the fundamental wave, and the second and the third harmonics.

(3) Moreover, when the abdominal muscles (M. rect. abd., M. obliq. abd. and M. trans. abd.) are cut, the inspiration is little changed from the previous case. But the peak of expiration exists in the first half and the small wave appears in the final half. The process from the expiration to the inspiration is step-like. This is regarded as the extreme point of inflexion when the N. phrenicus is cut. In FOURIER's progression, the amplitude of the fundamental wave decreases and the higher harmonics appears.

(4) When the N. phrenicus is cut, the phase of each harmonics is greater than in the other cases, and the ratio between the inspiratory and expiratory duration increases.

(5) The inspiratory and expiratory volume is equal in all cases, but when the abdominal muscles are cut, each value is smaller than the others.

From these results, we presumed as follows:

(1) The fundamental wave of FOURIER's progression relates mainly to the movement of the thorax; the second harmonics to the movement of the abdomen; and the third harmonics to the movement of the diaphragm. The phase of each harmonics is in relation to the respiratory duration.

(2) There are the phase-differences among the movements of the thorax, the abdomen and the diaphragm.

(3) The diaphragm causes the respiratory process to be smooth by its elasticity, and its additional rhythmic contraction.

(4) The respiratory movement is regulated always to keep the inspiratory and expiratory volume almost equal.

(5) The abdominal muscles are very important factors in the respiratory movement, and they have a rhythmic contraction independent of other factors.

161. Electromyographic studies on the so-called resting posture of the dog, and the rabbit. Toshio OKABE, Shin-ichi NOMURA, Hiroshi SAWAZAKI and Hichiro INADA (Journ. Jap. Vet. Med. Ass. **7**, 412-415, 1954)

The canine sitting posture and the crouching posture of rabbits are considered to be resting postures because of the easiness of these postures. The experiments in this report were designed to settle whether these postures were resting ones or not, and antigravitational muscular activity was investigated in both postures electromyographically for this purpose.

In the canine sitting posture, the trunk takes a diagonal position and most of the joints of the thoracic limb are fixed antagonistically by their extensors and felxors to support this diagonally situated trunk, and the number of antigravity muscles in action exceeds that in the normal standing posture. The pelvis stands nearly straight, and the hip and stifle joints are situated at the positions of their terminal flexion, and the metatarsal bones rest on the ground. Therefore, the activity of a few antigravity muscles is sufficient to hold the joints of the pelvic

limb in place, because of these mechanical advantages.

In the crouching posture of rabbits, most of joints are fixed antagonistically and many antigravity muscles are concerned in the maintenance of this posture, and furthermore their activity is considerably strong. From these observations it is obvious that it is not easy to maintain this posture for a long period of time. From results obtained here, it necessarily follows that the cannine sitting posture and the crouching posture of rabbits are not considered to be resting postures but the latter is eqhivalent to the normal standing posture of other domestic animals.

162. Electromyographic studies on the function of the skeletal muscles. I. On the standing posture of the goat. Shin-ichi NOMURA, Hiroshi SAWAZAKI and Hichiro INADA (Jap. Journ. Vet. Sci. **16**, 261-269, 1954)

The activity of the skeletal muscles in relation to the symmetrical standing posture, classified into normal, forward- and backward-inclined, etc., was investigated through the use of the electromyographic technique. Based on the results obtained, the manner of the muscle contraction in each posture was discussed.

(1) The activity of the muscles in the standing posture changes with the location of the centre of gravity and fixation of the articulations tc maintain equilibrium of the posture at that occasion.

(2) In both the normal and the forward-inclined standing postures, most of the joints of the limb are fixed by the muscles from one side at their maximum stretch, i.e., not antagonistically, while the hip joint is fixed antagonistically by the iliopsoas and gluteal muscles. Intensity of the contraction of the muscles in the normal, is generally weaker than that of the forward-inclined. Fixation of the majority of the joints in the backward-inclined standing posture is bilaterally, i.e., antagonistically, at an intermediate position between flexion and stretching, which is supposed to consume more energy than the other two.

(3) The number of neuromuscular units in the action or discharge frequency of each unit always varies to a certain extent. The undulation of the activity of NMU with the respiratory movement or the forward and backward movements of the body has been brought about by the postural reflex or voluntary regulations.

163. Study on the chronaxy of subordination of the muscle on domestic animals. I. A critical study of a method for the measuring of the normal chronaxy and its determination. Toshio OKABE, Hichiro INADA and Hiroshi SAWAZAKI (Jap. Journ. Zootech. Sci. **26**, 45-52, 1955)

As we have found some defects in the method for measuring the normal chronaxy and its treatment, we made a critical study of them. We determined the motor points of 23 superficial muscles of rabbit prior to our experiment as they are not determined yet.

We compared the continuous measurement without intervals with the repeated measurement of 3 minute intervals.

The results are as follows:

(A) From the continuous measurement without intervals.

(1) We can reject the randomness of measures by testing with the Run at the limit of a significance of 5%.

(2) Series of measures has trend.

(B) From the repeated measurements of 3 minute intervals.

(1) We cannot reject the randomness of measures by testing with Run in all cases.

(2) Trend appeared in only one of five experiments.

(3) A few significant coefficients of auto-correlation are calculated at the limit of significance of 5% in the series of measures which have not trend.

(4) The distributions of measures are regarded as the normal distributions in all experiments.

So, we conclude as follows:

(1) The continuous measurement without intervals is not adequate for the determination of the normal chronaxy.

(2) We decide that the normal chronaxy of a certain muscle of an individual ought to be given by a certain range, i.e., 70% variance which is estimated from five measures obtained by the repeated measurements with intervals of at least 3 minutes and the mean of the five measures ought to be shown as the representative values.

(3) Normal chronaxies of the M. extensor hallucis longus and the M. biceps femoris of matured rabbit, determined by our method are as follows:

M. extensor hallucis longus	0.080 – 0.193 ms.
M. biceps femoris	0.073 – 0.222 ms.

164. On the periodic fluctuations of the phonocardiogram of rabbit. Toshio OKABE, Yoshio MOCHIZUKI and Satoshi TOMINAGA (Journ. Jap. Vet. Med. Ass. **8**, 225-228, 1955)

Heart sounds, picked up from the breast-wall through a crystalline microphone with a slender megaphone, were amplified by a specially designed amplifier and the out-put of this amplifier was connected with a loud speaker, and vibrations of the corn of the speaker was recorded on sooted papers by a kymographion.

Time serise analyses were applied to five series, which were obtained from five healthy rabbits by this means, and consisted of about 200 heart sounds respectively.

Two kinds of undulations appear in a series of loudness of the 1st heart sound, i.e., the magnitude of the 1st heart sound of the phonocardiogram: the one is a slow undulation with a period of 20～30 sec. and another is a irregular fluctuation. Furthermore, it is found that two regular harmonic undulations are revealed as components of this irregular fluctuation: the one has a period of 4～5 sec. and another has a period of about 1 sec. and the latter corresponds with the respiratory movement. Also, the deviation of the magnitude from the slow undulation, undulates with a period of about 5 sec. These undulations overlap each other and thus the magnitude diagram takes an appearance of damped oscillation.

165. Mechanism of the costovertebral joint. Hiroshi SAWAZAKI and Shin-ichi NOMURA (Jap. Journ. Vet. Sci. **17**, 1-6, 1955)

The mechanical studies on ribs were based on the morphological observations in the beginning of the twentieth century, therefore the explanation of the rela-

tion between the respiratory muscles and the mechanism of the thorax is not clear. So, in the beginning, we tried to analyse the mechanical characteristics on the costo-vertebral joint.

Subjects are the three right series of ribs, in cattle. We analysed the extents of movement, the inclination-angles of the bone axis, the instantaneous axes of flexion and extension, the angles of pivot-movement and the O. FISCHER's axes of rotation.

The results are as follows:

(1) Undoubtedly a series of ribs are divided into the following four parts: the first rib, the fore, middle and hind parts. STRASSER and KEITH divided it morphologically, into the same parts in man, and WATANABE pointed out the characteristics of the first rib and the differences between the upper and lower ribs, from the systematic observations on the inclined-angles of the ribs in men. It is very interesting that the same results are obtained from the cattle, mechanically.

(2) The first rib takes the adduction and the inward pivot-movement during expiratory phase.

(3) In the fore part, the extent of the movement is small and the locus of bone axis is horizontal, and thus it seems that its movement is limited by the thoracic appendage from both sides of the body.

(4) In the middle and hind parts, the direction of the pivot is opposite to that of the other parts (outward pivot-movement) and moreover the hind part takes the adduction too.

(5) In the reports previously quoted, the authors did not clearly recognize the pivot-movement of the rib, but from the results obtained here, the movements of the rib promote to compress the thorax during expiration by the adduction and rotation.

166. On the method of emasculation by means of cutting off the *Vas-deferens* in dogs. Shin OKOSHI, Takeo TAKAHASHI, Toshio ISHII, Mampei USUI, Isamu TOMODA, Masanobu FUKUI and Hiroshi ITAGAKI (Journ. Vet. Med. [Jui-Chikusan Shimpo] **138**, 3, 1954) (Journ. Jap. Vet. Med. Ass. **8** [3-extra edition], 41, 1955)

We made a trial of the emasculation by means of cutting off the *Vas-deferens* in order to take off the reproductive power in male dogs without cutting off the gonads. So we tried two methods. One is as follows; at first, cut the skin 1 cm length at the region of groin, take out the *Vas-deferens*, cut it off 1 to 2 cm and then suture the skin. The other method is carried out in the same way as the first method at the cervical region of the scrotum. By these methods the operation may be finished briefly within fifteen minutes and scarcely is there any blooding.

167. On the clinical cases of canine amoebiasis. Shin OKOSHI, Takeo TAKAHASHI, Toshio ISHII, Mampei USUI, Isamu TOMODA and Tetsu SHIMABUKURO (Journ. Jap. Vet. Med. Ass. **7** [8-extra edition], 27, 1954)

A dachs-hund and two french poodles from U.S.A. came to veterinary hospital suffering from diarrhoea diagnosed as *Entamoebiasis hisolytica.* The symptoms were vomiting, diarrhoea mixed mucous and blood with bad smell, salivation, anemia and poor appetite. By the oral and rectal administration of Carvamisin the patients were recovered.

168. Supplement to the report on the amoebiasis. Shin OKOSHI, Takeo TAKAHASHI, Toshio ISHII, Mampei USUI, Isamu TOMODA and Masanobu FUKUI (Journ. Jap. Vet. Med. Ass. **8** [3-extra edition], 40, 1955)

Three dogs from Japan, a sheep from Japan, three lions from U.S.A. and a Bengal monkey from India were suffering from diarrhoea with mixed mucous and blood. The authors diagnosed the disease of these patients as amoebic dysentery. The oral and rectal administration of Carvamisin was effective, but on the other hand the administration of Sulfamine was able to alleviate the symptoms but could not cure it completely.

169. Studies on amoebic dysentery in domestic animals. Shin OKOSHI, Takeo TAKAHASHI, Toshio ISHII, Mampei USUI, Isamu TOMODA, Masanobu FUKUI, Hiroshi ITAGAKI and Yukiharu To (Rep. 14th meeting East. Div., Jap. Soc. Parasit. 3, 1954)

We have diagnosed nine canine Entamoebiasis in this eighteen months since March 1953. But on the cat we have never diagnosed amoebic dysentery before June 1954.

The symptoms observed on the cat were as follows; normal temperature, poor appetite, salivation, diarrhoea with mixed mucous and blood and bad smell, ulcer on the oral mucous membrane and depilation. By the oral and rectal administrations of Carvamisin, the patients recovered ten days later.

170. On the clinical views of tuberculosis in three dogs. Shin OKOSHI, Takeo TAKAHASHI, Toshio ISHII, Mampei USUI, Isamu TOMODA, Tetsu SHIMABUKURO and Yukitoshi INOUE (Journ. Jap. Vet. Med. Ass. **7** [8-extra edition], 12, 1954)

A dog from Tokyo was sent to the veterinary hospital on August 1951 and died nine days later. By a postmortem and pathological examination, the tubercle bacilli of human type were isolated from the abdominal exudation and other diseased parts of the internal organs.

The second dog from Tokyo, was attacked with the disease on January 1953, and was killed by owner's desire, 77 days later. By a postmortem and pathological examination, the tubercle bacilli of human type were isolated.

The third dog from Yokohama came to the hospital on February 1953. By examination of the thoracic exudate, the tubercle bacilli of human type were isolated, and so the patient was diagnosed as to have the tubercle pleuritis.

The symptoms of these three dogs were as follows; cough, nasal discharge, stenchy respiration, thoracic exudate, pleuritis, ascites and enlargement of the lymph gland.

171. Studies on the influences of the simultaneous administration of alkali with sulfamin in dogs, especially on the function of kidney and pH of urine. Shin OKOSHI, Isamu TOMODA, Masanobu FUKUI and Hiroshi ITAGAKI (Journ. Jap. Vet. Med. Ass. **8** [3-extra edition], 43, 1955)

The authors studied on the pH of urine by the glass-electrode method and the function of kidney by the phenolsulfonphthalein test in order to investigate the influences of sodium-bicarbonate (0.1 g/kg) by a serial administration of the combined sulfanilamides (0.5 g each of sulfathiazole, sulfathiazine and sulfamerazine, every 12 hours for 10 days) on dogs.

The simultaneous administration of sodium-bicarbonate alkalized the urine for a long time and prevented the renal disturbance from crystalluria, occasionaly produced by the serial administration of sulfanilamides.

172. Comparative anatomy of three common pond-snails from Japan; *Lymnaea ollula, L. japonica* and *L. truncatula*. Shin OKOSHI and Hiroshi ITAGAKI (Jap. Journ. Parasit. **4**, 123, 1955)

The genus *Lymnaea* has so much variation in shell feature that identification by shell happens to be difficult. We studied the comparative anatomy of three pond snails, incriminated as intermediate hosts of some trematodes, from Japan (*Lymnaea ollula, L. japonica* and *L. truncatula*) and defined the characteristics of the snails. Namely, specific characteristics are found in such organs as the salivary gland, the caecum, the hermaphrodite gland, the diverticula of the hermaphorodite duct, the spermatheca, the retractor muscles of the male copulatory organ, the pedal ganglion and the statocyst. Moreover, the color of the snail is a distinguishing characteristic of the species. That of *L. ollula* and of *L. truncatula* are darkish grey, and that of *L. japonica* is yellowish brown. Measurement of the eggs of these snails show as follows: *L. japonica* 910 by 703 μ, *L. truncatla* 650 by 580 μ, *L. ollula* 824 by 602 μ. The gelatinous eggs-mass of *L. japonica* is hard, while those of *L. truncatla* and *L. ollula* are soft.

173. 22A intramedullary pinning of long bones of the dog. Hikozo ICHIKI and Masaaki HATAYA (Journ. Jap. Vet. Med. Ass. **7**, 498-503, 1954)

There are a number of procedures recommended for the treatment of nonunion in fractures. In general, however, it is not easy to provided proper immobilization of fractured bones in animals. The authors tried to apply intramedullary pinning to the fractures of long bones of the dog and obtained good results. 10 dogs including 14 cases of fracture were treated. (Table 1.)

Table 1. Clinical cases treated by intramedullary pinning

No.	Date of operation 1954	Species	Sex	Age	Site of fracture	Date of removal of pin
1	Apr. 19	Shepherd	female	2 mon.	Both femurs	unremoved
2	June 16	Mongrel	male	2 mon.	Right humerus and tibia	unremoved
3	July 15	Spitz	female	9 mon.	Left femur	Aug. 18
4	July 30	Collie	female	3 mon.	Left femur	Aug. 31
5	Aug. 5	Shepherd	male	2 mon.	Right femur and tibia	unremoved
6	Aug. 5	Collie	male	3 mon.	Left femur	unremoved
7	Aug. 11	Japanese	male	9 mon.	Left femur	unremoved
8	Aug. 25	Mongrel	male	4 mon.	Right femur	Sept. 27
9	Sept. 22	Collie	female	3 mon.	Both femurs	unremoved
10	Oct. 13	Mongrel	male	4 years	Right tibia	unremoved

The intramedullary pins used were round or triangular pins and made of 22A stainless steel. 22A is a nonmagnetic surgical stainless steel, composed of Cr. (19–21%), Ni. (21–23%), Mo. (1.5–2.5%), C. (<0.1%), Cu. (1.5–2.5%) and Fe. It

was deviced in 1951 by Prof. IINO and Prof. IMAI of Tohoku University Sendai, Japan, and its excellent quality for surgical use is well recognized as comparable with that of Vitallium.

Technique:

(1) Femur.

Under intravenous anesthesia of pentobarbital sodium (25 mg/kg B.W.), a skin incision approximately 3 cm. long was made over the hip joint and the cortex of the femur was drilled at the trachanteric fossa. A 22A pin was then inserted into the medullary cavity of the proximal fragment of the bone by hammering. Then the proximal and distal fragments of the bone were aligned in apposition by open or closed reduction. And the pin was pushed down through the marrow cavity of the distal fragment until the pin was obstructed by the osseous structures of the distal end. Always a pin of suitable size and length was chosen in advance before the operation started.

(2) Tibia.

The stifle joint was flexed as far as possible, and the skin incision was made in front of the joint and the tendinous insertion of the quadriceps femoris group of muscles was incised. The cortex was drilled at the fossulae intercondyloideae, just anterior to the joint capsule and the medial meniscus. Then the pin was inserted into the proximal fragment, and the fracture was fixed as in the femur.

(3) Humerus.

The skin incision was made over the shoulder joint and the cortex was drilled at the point in the hollow between the greater and the lesser tubercles. Then the pin was inserted into the proximal fragment. The fixation was completed by the same procedures as above mentioned.

It is observed that fractures of long bones in the dog are fixed more rigid and firm and heal more rapidly, if a pin is inserted through the medullary cavity. Most of the dogs treated could stand on the injured leg within one or two weeks and walk naturally in a month. Four cases of multiple fracture (No. 1, 2, 5, 9) were treated satisfactorily by this method and all patients returned to normal function in a month. After the fractures healed up, the pins were removed in three cases and in others were left in the marrow cavity. The 22A pins removed showed no rust nor any other change, and the pins left unremoved did not show harmful results to the health of the patients. There was neither atrophy of muscles nor stiffness of the joint observed. And this treatment showed little tendency to delay the growth of puppies. 22A intramedullary pinning is considered to be one of the most useful methods of fixing the fractures of long bones of dogs.

174. Pentobarbital anesthesia of the dogs. Masaaki HATAYA, Tetsuo FUFITA, Hikozo ICHIKI, Shigekazu MOTOYOSHI and Yasuhito KUSUNOKI (Journ. Jap. Vet. Med. Ass. 8, 220, 1955)

It is well known that the derivatives of barbituric acid have powerful narcotic actions. According to the duration of narcotic action, the barbiturates are classified into the long-, short- and ultrashort-actors and pentobarbital (Nembutal) belongs to the short-acting group.

In 1931, KREUTZER, HAIGLER and SWEEBE reported that pentobarbital was useful as a general anesthetic drug in veterinary surgery. At first, however, entirely consistent results were not obtained, when it was administered orally or intraperitoneally and it was recommended to administer it by intravenous injection. By this means, varying depths of anesthesia could be induced at will, overdosage avoided and the safety factor greatly increased.

The authors administered pentobarbital or pentobarbital sodium to 152 mongrel dogs intravenously and to 17 dogs intraperitoneally. 10% propylen glycohol solution of pentobarbital was given intravenously with a rate of 60 seconds per each c.c. and pentobarbital sodium (5% water solution or 6% water solution with 10% alcohol and 20% propylen glycohol) was given with a rate of 30 seconds per each c.c.

The results obtained were as follows:

(1) The dose considered to be most suitable for general anesthesia of the dog, when pentobarbital or pentobarbital sodium was administered intravenously, was 25 mg per kilogram of body weight. Then the duration of surgical anesthesia in the extent of 1 to 1½ hours was obtained.

(2) Loss of consciousness and muscular relaxation were apparent and a satisfactory surgical anesthesia was obtained

(3) Respirations became shallow and slow. Blood pressure fell about 30 mm Hg during intravenous injection but recovered rapidly to the normal level just after the end of injection.

(4) After the drugs were administered, the values of haematocrit and haemoglobin of the circulating blood showed a decrease of 8–14% during the first 3 hours and recovered later normally. Leucocyte count showed a decrease of 14–28% and eosinophile count showed a decrease of 16–23% during 6 hours after injection and both counts changed almost parallel. It seemed, therefore, that pentobarbital might not act as a stress to the dog, in view of the appearance of leucocytosis accompanied with neutrophilia and eosinopenia under the stresses. Blood sugar levels did not show consistent results.

(5) In the stage of recovery, violent physical activities were observed at times but these were able to be avoided by keeping the body of the animals warm.

(6) It was necessary to make provision for hepatic dysfunction and reduce the dose accordingly.

(7) In animals which have been narcotized in advance by premedication, 20% of the dose pentobarbital required to induce anesthesia could be reduced.

(8) The effects of anesthesia induced by intraperitoneal injection of pentobarbital sodium in a dose of 30 mg per kilogram of body weight were almost uncertain compared with that of the cases administered intravenously.

175. Studies on the treatment and prevention of reproductive failures in livestock. I. Bacteriological examination of the vagina and uterus of healthy cows. Yuichi OCHI, Manabu OGATA, Shinichiro KONISHI and Eiichi YOSHIDA (Jap. Journ. Veter. Sci. **16**, 219-226, 1954)

Bovine infertility is mostly attributed to nutritional deficiencies, endocrine disorders or certain contageous diseases. Among these causes of reproductive failures, certain contageous diseases such as bovine brucellosis, venereal trichomoniasis or

vibriosis have been so well investigated that various kinds of therapeutic and prophylactic measures have already been taken, while non-contageous common diseases, including endometritis and vaginal catarrh, have not yet been well studied. But the significance of non-contageous diseases must be emphasized as they have been causing a great economic loss.

First of all, as one of the basic studies on these common diseases, investigations were made on the vaginal and uterine flora in 98 normal cattle, slaughtered at the Shibaura Slaughter House in Tokyo.

Most of these cattle were of either black or brown Japanese breeds.

The vagina and uterus, entirely in one piece, were removed immediately after slaughter. Upon confirmation of the absence of any pathological change, the internal walls of those organs were swabbed and cultures were made aerobically on both blood-agar and ordinary agar plate.

Out of the total 98 cases examined, those position of both vaginal and uterine swabs were 23, those positive of the vaginal swab only, were 48, those positive of the uterine swab only, were 2, while those negative in both cases were 25. Namely, cultures made with the vaginal swab were positive in 71 cases and those of the uterine swab were positive in 24 cases.

The families of those bacteria recovered are as follows and the frequency of their appearance is in the order listed:

(1) Micrococcaceae (Micrococcus pyogenes var. albus, aureus, Micrococcus citreus and few other non-identified Gram-negative and Gram-positive cocci) ...... Vagina 90%, Uterus 96%.
(2) Non-identified Gram-positive non-spore bearing bacillus ...... Vagina 55%, Uterus 56%.
(3) Enterobacteriaceae (Esch. coli and few other proteus, non-identified non-lactose fermenting organisms) ...... Vagina 45%, Uterus 56%.
(4) Non-identified Gram-negative bacillus ...... Vagina 37%, Uterus 36%.
(5) Bacillaceae ...... Vagina 24%, Uterus 16%.
(6) Corynebacteriaceae (Not including Cory. pyogenes) ...... Vagina 18%, Uterus 20%.
(7) Lactobacteriaceae (Streptococcus) ...... Vagina 17%, Uterus 0.4%.
(8) Neisseriaceae ...... Vagina 3%, Uterus 1%.
(9) Pseudomonadaceae ...... Vagina 1%, Uterus 0%.

Bacteria present in the vagina and the uterus of cattle are extremely small in number, then colonies formed being only 1 to 10 in 50% and 10 to 100 in 37% of the total positive cases when cultivation was done by the swab method.

176. Studies on the equine infectious anemia. I. On the isolation of the virus through mice. Yuichi OCHI and Manabu OGATA (Experimental Report on Equine Infectious Anemai 1, 85-91, 1955. Hokkaido Prefectural Government)

Experimental data in regard to the negative results in the transmission of equine infectious anemia to hosts other than solipeds are too numerous to be cited. ARAKAWA et al. (1952) reported, however, the virus was easily isolated in young mice inoculated with the serum of infected horses. This finding is very important, because so far all animal experiments of this disease have been made only by using

the members of horse family, and no laboratory animal has been found susceptible.

Thus the following studies were made on the isolation of the virus in mice.

Methods and results are as follows:

The equine infectious anemia serum used for the infection of mice in the present study were obtained from the Government Experimental Station for Animal Hygiene, Tokyo.

The horses bled were all identified clinically, haematologically and pathologically as those infected with equine infectious anemia.

Five of them were bled while the animals were developing fever after natural or artificial infection.

Of those serum specimens, three were ultracentrifuged at 40,000 r.p.m. for one hour.

Another specimen was collected from the horse died of spontaneous infection and was used as the mixture of spleen, liver and serum.

The specimens were inoculated intracerebrally each in a dose of 0.02–0.03 c.c. into baby or suckling mice of ddN strain or unknown breed. They were sacrificed 4 or 5 days (occasionally 3 or 6 days) after inoculation. The brains of infected mice were prepared into 10% emulsions and the supernatants after centrifugation at 3,000 r.p.m. for 10 minutes were passed in young mice through 6, 10 or 13 serial passages.

No transferable encephalitic symptom was observed and the virus isolation was negative in all the mice tested. Further studies are in progress, but so far there has been no sign whatsoever suggestive, of positive isolation.

177. **Natural infection of Japanese B encephalitis virus on monkeys.** Manabu OGATA, Kiichi ISHIDA and Yuichi OCHI (Jap. Journ. Veter. Sci. **17**, 7-11, 1955)

It has been accepted that monkeys are susceptible to the Japanese B encephalitis virus on the results of studies made on artificially infected monkeys. However, we can find no report on natural infection by Japanese B encephalitis on monkeys.

Investigation was made of the two monkeys which died of encephalitis, and a neurotropic virus was isolated from one of them.

This virus was identified as the Japanese B encephalitis virus.

178. **Studies on Avian type tuberculosis. VII. Intravenous injection into the chick embryo with Avian and Bovine Tubercle Bacilli.** Shutaro YAMAMOTO, Kiichi ISHIDA, Kosaku FUJIWARA and Akio SATO (Jap. Journ. Vet. Sci. **15**, Suppl., 132-133, 1954)

The reaction of chick embryos against intravenous injection of human tubercle bacilli was reported by LEE, et al, in 1947. The authors examined the reaction of chick embryos against intravenous injection of avian and bovine tubercle bacilli. Intravenous injection of bovine bacilli causes hepatolienal swelling and formation of nodular lesions in the spleen of the chick embryos even with the dosage of 0.01 mg. The growth of the chick embryos was markedly inhibited and most of them died before hatching. The avian bacilli, on the contrary, did not produce lesions with smaller dosage, and the embryos complete their normal growth and hatching, after which the chickens succumbed invariably with generalized tuber-

culosis. 5 mg. of virulent avian tubercle bacilli was needed to produce lesions in the embryonic organs. With such a large dosage the lesions were also produced even by avirulent acid-fast bacteria, such as BCG or Timothy.

The reactions of the chorioalantoic membrane against avian and bovine tubercle bacilli dropped on the membrane were also examined. The bovine bacilli dropped on the chorioalantoic membrane caused severe proliferation, tubercle formation and necrosis in the mesodermal layer, but there were no marked changes in the ectodermal layer. The avian bacilli dropped on the membrane, on the contrary, produced proliferation of the ectodermal cells and numerous bacilli were found in the proliferated ectodermal cells, whereas the reaction of the mesodermal layer against avian bacilli was almost absent.

179. Studies on Avian type tuberculosis. VIII. Articular lesions in chronic type of experimental Avian tuberculosis in rabbits. Shutaro YAMAMOTO, Kiichi ISHIDA, Kosaku FUJIWARA and Akio SATO (Jap. Journ. Vet. Sci. **16**, Suppl. 27, 1954)

The articular lesions which appeared in chronic VILLEMIN type of the experimental avian tuberculosis in rabbits were examined. 16 rabbits which showed articular lesions are divided into the following 3 groups. 1. 10 rabbits inoculated with single doses of a small amount of the bacilli. Duration of life was 13–62 weeks. ....Non-treated group. 2. 3 animals which received relatively large dosage (0.1 mg./kg. i.v.) and survived for 21 to 35 weeks by streptomycin treatment. ....SM group, and 3. 3 sensitized rabbits which survived 28 to 41 weeks after intravenous reinoculation of virulent strain of avian tubercle bacilli. ....Sensitized group.

The number of the affected joints in each group was examined with statistical method and the results obtained are summarized as follows.

(1) The keeping condition in each group is the same.

(2) There is no difference in the number of affected joints between Non-treated and SM group.

(3) The number of affected joints in Sensitized group is apparently larger than the other groups.

(4) The lesions appear with relative frequency in the joints of the limbs than in the costovertebral joints.

(5) Among the joints of the limbs, elbow joints are affected most frequently.

(6) There is no difference in the frequency of the articular lesions between both body sides.

180. Studies on Canine tuberculosis. Shutaro YAMAMOTO, Kiichi ISHIDA, Kosaku FUJIWARA and Akio SATO (Jap. Journ. Vet. Sci. **16**, 187-196, 1954)

The occurrence of spontaneous canine tuberculosis has not been reported for a long time in this country. Dr. EMOTO, the former professor of our laboratory, reported one case of canine tuberculosis in omentum, in 1916. In Manchuria Dr. HIROKI reported a case of spontaneous canine tuberculosis, in 1936. Both cases diagnosed as infection with the human type tubercle bacilli.

Recently, during a period of about 2 years, the authors have observed 4 fatal cases of spontaneous canine tuberculosis, in Tokyo. The results obtained are sum-

Table The Distribution of the Lesions.

Case No.	Age	Sex	Distribution of the Lesions								
			Lung	Pleura	Perito-neum	Liver	Spleen	Kidney	In-testine	Mesente-ric Lymph node	Skin
1	1 Y.	♂	+	−	+++	−	−	−	−	+++	−
2	1 Y.	♂	+++	++	−	++	−	++	−	++	+++
3	7 Y.	♂	++	+++	+++	+++	−	−	−	+++	−
4	7 Y.	♀	+++	+++	−	−	−	−	−	−	−

marized as follows:

(1) The distribution of the lesions in individual cases in shown in the Table. The involvement of the lung was observed in all cases and cavity formation was noted in the second and fourth cases: the former case was apparently open tuberculosis. The cavity in the last case was somewhat compressed by atelectasis due to the accumulation of a large amount of exudate in the thoracic cavity of the same side, and it was not ascertained, by histopathological examination, whether this lesion was open or closed.

(2) Frequent involvement of the serous membranes was confirmed as shown in the Table.

(3) Skin lesions were observed in the second case, and this is important as the source of discharge of the tubercle bacilli.

(4) Involvement of the mesenteric lymph nodes were observed in three cases, none of which were associated with the tuberculous lesion of the intestines.

(5) Affected lymph nodes do not show circumscribed nodular lesions at the cut surface, and there is diffuse proliferation of the large mononnuclear cells throughout the organs.

(6) The cells which dominate the lesions are large mononuclear cells. The polymorphonuclear leucocytes, usually, do not play important roles in the lesions, even when central necrosis is apparent. Giant cells of any type including LANGHANS' giant cells, which are a characteristic of tuberculous lesions in man and animals, did not appear in our canine cases.

(7) It seems also to be peculiar to the canine tuberculosis, that the tubercle bacilli are usually easily demonstrable in the lesions or in the exudate and in some cases they are extremely abundant.

(8) Cultures of acid-fast bacteria were easily obtained from each case, and they were all verified as the tubercle bacilli of the human type.

181. Studies on the so-called streptothricosis canum. Shutaro YAMAMOTO, Kiichi ISHIDA, Kosaku FUJIWARA and Akio SATO (Jap. Journ. Vet. Sci. 16, 197-208, 1954)

The authors have described 6 cases of the so-called streptothricosis in dogs, which has been hitherto unknown in Japan. The disease was recognized during the

recent two years as a disease resembling tuberculosis. In most cases the diagnosis of this disease was made through autopsy after which the Gram stained preparations were made and examined.

The lesions were of the purulent-granulomatous in nature and the lungs and bronchial lymph nodes were most frequently affected (Case Nos. 2, 3 and 4). The lesions of the lung appear as greyish white nodules of soy bean size, which are situated closely under the pleura, or as circumscribed catarrhal bronchopneumonia. The bronchial lymph nodes are highly affected and the lymphatic tissues almost completely disappear, superseded by severe infiltration of large mononuclear cells and polymorphonuclear leucocytes.

There are two cases of omental lesions, one of which (Case No. 1) shows a greyish white tumorous mass of the size of a child's fist in the region of the stomach and the other (Case No. 5) shows granulomatous thickening of the omentum, brownish red in color, which macroscopically resembles tuberculous lesion of the omentum.

Subcutaneous lesions were observed in two cases (Nos. 1 & 6). The former one shows a straight tear of the skin in the region of the neck and the other a phlegmonous swelling of the left shoulder. Small abscesses were found in the spleen, kidney and heart muscle of the second case, and minute foci of large mononuclear cells and polymorphonuclears in the liver of the 5th case, which sometimes invaded the branches of the portal vein.

Gram positive, branched slender filaments are demonstrated in each of these lesions, which lie scattered in the lesions, except in one (Case No. 2), in which masses of filaments show a druse like appearance.

It seems peculiar that there was hypoplasia of the splenic follicles and lymphatic tissues of the non-affected lymph nodes. These findings should be closely related with the marked lymphopenia, that had been observed in two of our cases (No. 2 7.8% and No. 6 9.7%) which were examined hematologically.

The authors isolated Gram positive slender branched filaments, aerobically, from each cases. They are partially acid fast, breaking up into short rods or coccoid forms after a few days cultivation. Most of the colonies adhere firmly to the surface of the solid media and they are non proteolytic. The authors conclude that they are of the Genus Nocardia or closely related organisms.

182. Studies on toxoplasmosis in animals I. Report of a case in cat. Shutaro YAMAMOTO, Kiichi ISHIDA and Kosaku FUJIWARA (Jap. Journ. Vet. Sci. **17**, 13-18, 1955)

Toxoplasmosis is one of the most important anthropozoonosis of world-wide distribution. In this country, the existence of this disease was first recognized by PROWAZEK (1910) in the preparation of mole collected by Dr. MINE in Fukuoka. In 1939, 2 cases in racoon-dog were reported by Prof. HIRATO, in Hokkaido. One canine case was also reported in Hokkaido district by Prof. HAMADA in 1951. These cases were based on morphological characteristics of the parasites found in the lesions. Recent studies by HASEGAWA, et al., on the serological survey of toxoplasmosis using RH strain suggested the wide spread latent infection among humans and animals in Japan.

The authors have isolated the first strain of Toxoplasma in Japan from ascites of a cat. The cat was a 2 year-old male, kept in Tokyo. Marked accumulation of viscous ascites, anorexia and emaciation were noted. The cat died after about 3 weeks of illness. Attempt to isolate Toxoplasma was made by mouse passage, as suspicious small bodies were found in smear preparation of the cat ascites, and typical crescentic Toxoplasma parasites were found in the peritoneal exudate, spleen and lung of the mouse dead 17 days after primary inoculation. The strain thus obtained was identifiel by SABIN-FELDMAN's dye-test and biological properties as typical Toxoplasma.

At the postmortem examination of the cat, there was accumulation of large amounts of viscous ascites and greyish white coverings were noted on the serosa of liver, spleen and intestine. Histopathological examination revealed subacute or chronic peritonitis and granulomatous lesions in the pancreas and liver. No significant changes were noted in the section of the brain nor were there any Toxoplasma parasites.

Minute spindle shaped bodies stained with hematoxylin were occasionally found in the large mononuclear cells of the intestinal serosa. Accumulation of small round bodies was also found in the liver cell.

183. Studies on leptospira I. Shutaro YAMAMOTO (The Nisshin Igaku **41**, 468-477, 1954)

The author carried out the serological tests of leptospiroses by SCHÜFFNER and MOCHTAR's agglutination-lysis test or NUMATA's macroscopical agllutination test. From canine cases in Tokyo 3 strains of *L. canicola* were isolated, and the author recognized the relationship between leptospiral serological test and interstitial non purulent nephritis in dogs. Mixture of several strains of culture of Leptospira killed with 0.5% of phenol will be effective for prevention purposes of canine leptospiroses. Dogs in Shizuoka prefecture, an endemic area of human autumn fever, were also investigated, and the author observed the infection with *L. icterohaemorrhagiae* and *L. canicola* with the isolation of *L. hebdomadis*. In Hyogo prefecture in 1950 the author tested 26 reconvalescent sera of so-called haemoglobinuria of cattle and found 6 cattle infected with *L. australis A*, 15 cattle infected with *L. autumnalis* and 3 cattle infected with *L. hebdomadis*. 2 strains of *L. hebdomadis* were cultivated from these bovine cases in the autumn of 1950. Therapeutic tests of bovine leptospiroses with penicillin were performed and it was recognized that penicillin therapy did not disturb the serological diagnosis. On the other hand 36 cases of periodic ophthalmia of horses in Japan were tested serologically and all of them showed positive reaction with one or another strain of leptospira. In these cases 7 were recognized as double infection with 2 strains which had not any antigenic relationships. The titration of body fluids (serum, cerebrospinal fluid, aqueus humor, liquor pericardi and urine) of immunized goat and rabbits was performed . The titer of aqueus humor was similar to that of cerebrospinal fluid and about one thousandth of serum titer. From these findings and also from the existence of meningitis in leptospiroses it can be said that the uveitis is caused by leptospira.

184. Studies on leptospira II. Shutaro YAMAMOTO (The Nisshin Igaku **41**, 527-539, 1954)

The studies on the serological classifcation of leptospira were originated by Prof. INADA and coworkers in the year 1917 when *L. hebdomadis* was isolated. A great deal of the works in this field of research were performed recently by European workers with advanced serological technics. And numerous new species of leptospira were described in various countries. The author modified one strain of *L. canicola* by the passage with 63 generations of guinea pigs into a strong virulent strain but the serological properties of the strain was stable. Then the author realized the serological properties of leptospira were not so labile.

By the SCHÜFFNER and MOCHTAR's technic the author had classified serologically into 10 groups the testing 46 strains collected from various countries including the 6 isolated in Japan.

It is to be advocated that perfect serological diagnosis can be done using as antigens 11 strains, the typical strains chosen from each one of the 10 groups and *L. canicola*. With SCHÜFFNER and BOHLANDER's cross absorption tests Japanese *L. hebdomadis* C. SHIOZAWA et KUBO 1938 was identified with the Australian *L. australis A* LUMLEY 1937 and Japanese "Okinawa" strain was identified with *L. pyrogenes* VERVOORT 1923. And other complicated serological properties of the leptospira strains are demonstrated as shown in table.

185. Situation récente de la Recherche sur l'Ophtalmie périodique du Cheval au Japon. Shiutaro YAMAMOTO (Bull. Off. Internat. Epiz. **53**, 425-432, 1955)

Even in Japan the causative factors of periodic ophtalmia in horses had been attributed, by many authors, to the influence of severe sunshine, heredity, insufficient nutrition, parasites, filtrable virus or allergy. About twenty years ago the author investigated the kidney of a diseased horse with the staining of Levaditi and found leptospira-like bodies. In this paper the author describes that 36 cases of periodic ophtalmia of horses in Japan were tested serologically and all of them showed positive reaction with one or another strain of leptospira. In these cases, 7 were recognized as double infection with 2 strain which had no antigenic relation. On the other hand the titration of body fluids (serum, cerebrospinal fluid, aqueous humor, liquor pericardi and urine) of immunized goat and rabbits was performed. The titer of aqueous humor was similar to that of cerebrospinal fluid and about 1/1,000 of serum titer. From these findings and also from the possibility of the existence of meningitis in leptospirosis, it can be said that uveitis is caused by leptospira.